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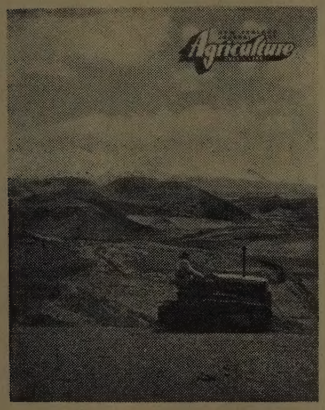
This Month's Cover



With the availability of aircraft for topdressing and of heavy machinery for cultivation, land development in New Zealand is reaching out to areas previously considered unfruitful. One such area is the extensive tract of pumice country near the centre of the North Island round Waiouru. Portion of this high-altitude area (over 2000ft. above sea level) that is being converted from native tussock to sown pastures is shown on this month's cover, which has been reproduced from a colour photograph by National Publicity Studios. A description of the methods being used and a history of the country are given in an article on page 3 of this issue. The mountains in the background are Ruapehu (9175ft.) at left and Ngauruhoe (7515ft.).

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Rotorua
Te Kuiti
A
Taumarunui
B
Lake Taupo
Gisborne
Ohakune
C
Waiouru
Napier

The Waiouru Tussock Lands

By G. R. MOSS,
Field Instructor, Department of Agriculture, Wanganui

THERE is an increasing interest in land development in the centre of the North Island and many questions are being asked about the future of the Waiouru tussock lands. In this article some of the early history and problems of this region and present land development practices are discussed. Waiouru, or "Upper Waters" as the name has been interpreted, is a township in Waimarino and Rangitikei Counties and is about half-way between the towns of Taihape and Ohakune. Both the Main Trunk Railway and the north-south highway pass through the township, which is situated near the southern edge of the Central Plateau at an altitude of 2670ft.

MANY of the areas surrounding the township are undeveloped and are still in native tussock, the dominant species being the red tussock (*Danthonia rigida*).

Early History of Waiouru Run

Sheep were first introduced on to the tussock lands from the Taupo end of the "Desert" by the Rev. Thomas Grace in 1855. These sheep were lost during the sporadic fighting caused by Te Kooti's followers between 1869 and 1872.

It was not until 1879 that a further attempt was made to open up the area for sheep. Surprising as it may seem today, the main access was from Hawke's Bay, as in those days the country behind Taihape was inaccessible owing to the heavy bush and rugged terrain. The Grace brothers were the pioneer managers of the enterprise and the agents in the negotiations with the native owners. The owners of the first flocks were the Studholme brothers and Messrs. Moorhouse, Morrin, and Russell. The first mob of sheep consisted of 4000 Merinos supplied from Sir Donald McLean's station at Maraekakaho and Clifton Station at Cape Kidnappers. The area taken over was to be known as the Murimotu run and was a 21-year Maori lease, comprising roughly the Murimotu and Rangipo-Waiu survey blocks and covering an area of 200,000 acres. Virtually it included all the land between the edge of the bush west of Karioi and the Kaimanawa Ranges.

▲ Many areas are still in native tussock, the dominant species being red tussock (*Danthonia rigida*). Tussock that has had one cut of the discs can be seen in the background.

Early Difficulties

The partnership broke up when Morrin and Russell went bankrupt. Moorhouse disposed of his share, and in 1884 John Studholme took over his brother's share, thus becoming the sole lessee. In 1888-91 the carrying capacity of the run was between 35,000 and 40,000 sheep. The enterprise was full

← In the Waiouru district the soil pattern depends on the kind and depth of volcanic ash at the surface. The photograph shows the crater area of Mt. Ruapehu, which with Mt. Ngauruhoe, Mt. Tongariro, and the crater now filled by Lake Taupo was the source of the major ash showers in the centre of the North Island, the distribution of which is shown in the map. A—Taupo ash. B—Ngauruhoe ash. C—Tongariro ash. Photograph by National Publicity Studios. The map is adapted from a map of the Soil Bureau, Department of Scientific and Industrial Research.

of difficulties: Losses were very heavy because there were no fences and the sheep wandered on to the mountains and were lost in the snow. In one winter the losses exceeded 20,000 sheep. Native dogs were a problem and in the early years Mr. Studholme paid a bounty for killing them. Large metal traps were set and a pack of dog-killing bloodhounds was kept by Mr. Sutherland, the head shepherd at Waiouru. The remoteness from the market, the expense and difficulty of sending the wool out, and trouble with Maori tribes over land rights all added to the runholder's worries.

Waiouru before 1900 consisted of shepherds' huts and the accommodation house which was the overnight stop for travellers between Taupo and Pipiriki.

Transporting of Wool

Wool was at first taken to Napier in two stages. The first part of the journey was by pack horses and the second part by dray. A special rotary press, using a horse for power, made small square bales weighing 150lb. Each horse carried two bales, one on either side in "pockets" in a special pack saddle. One report states that 62 horses were employed in carrying the wool through to Napier. The track was difficult in parts and a number of horses were lost. The pack horses took about 3 days to complete their part of the journey and return to the station. For the second part of the journey, on the Hawke's Bay side (75 miles), the wool was carried in horse-drawn drays. Later, bullock wagons were used to take the wool to Pipiriki to be ferried down the Wanganui River. At a later stage wool was packed to the shores of Lake Taupo and ferried north in the small schooner Dauntless, until an alternative route was available when the advancing Main Trunk Railway line reached Hunterville and Mangaonoho. The wool was scoured on the station before being sent out.

Originally Waiouru was the site of the shepherds' huts. The headquarters of the run was at Karioi, then a thriving centre boasting an accommodation house, a store, and a racecourse. Later, the accommodation house was moved to the site of the old coaching stable at Waiouru, where it was stated a township was to be laid out. Waiouru, rather than Karioi, then became the overnight stop for travellers between Taupo and Pipiriki.

The road between Waiouru and Ohakune was built in 1891-94. The settlers were permitted to contract for the building of the road through the thick bush. In spite of great difficulties and hardships, the Desert Road was completed in 1894 by a gang of nearly 100 men. Before 1894 there was only a riding track. The rail did not reach Waiouru until 1907 and it was not until 1908 that the Main Trunk Railway was completed.

When Studholme's lease expired the State took over the area from the Maori landowners. Mr. J. Craig next leased the Waiouru run, which at this stage was less than one-third of the original area. The lease was a Crown lease under pastoral licence, which was equivalent to grazing rights for 21 years.

Rabbits Become Plentiful

Before 1905 Messrs. Duncan and Campion took over the homestead block. In 1905 Mr. A. C. Morton (later a senior lecturer at Massey Agricultural College) and his brother obtained part of the run and in 1906 acquired the remainder. Two years later the Mortons disposed of the run because they would not risk the effect of rabbits, which at this time were increasing rapidly. The rabbits became so bad that when Mr. H. J. Chapman sold to Mr. C. P. Hansen in 1916 the carrying capacity of the run was down to 15,000 sheep, the lowest for many years. Mr. Hansen did not farm it but sold all the stock and disposed of the land rights to Mr. Werzyl Schollum and family. At this stage in the history of the run the rental was 3d. an acre for the Kaimanawa block and 9d. an acre for the homestead block.

In 1920 Mr. F. J. Lysnar purchased the run. For the next 9 years the rabbit pest was extremely bad, erosion set in, and many of the tussock species so essential for sheep grazing were killed. At one stage blocks of land were leased out to rabbiters who paid rentals of up to £50 per block. There were 35 rabbiters on the run in 1929, and 35,000 rabbitskins were taken off that year. It is claimed that faulty stocking in the 1920s accentuated bad conditions until in 1929 the pastoral licence was cancelled and in its place a deferred payment licence was granted to Forest, Farm and Products Ltd., a family company of the Schollums. This latter licence was an agreement for sale and purchase on the instalment plan for the area of 67,450 acres.

Mr. E. C. Stephens, of Tangiwai, states that the rabbits were so bad on his run during 1927-30 that he was unable to run any stock at all. He made his living by killing the rabbits in winter and catching wild horses in summer. In 3 years 400 horses were caught, but their mortality rate was high in captivity. The surviving horses were sold to the Siberia Station, where they were used for the control of bidi-bidi (*Acaena sanguisorbae*). These wild horses, which can still be seen today, are believed to be descendants of a stallion and several mares which were liberated by Sir Donald McLean on the Kaingaroa Plain.

By 1932 the rabbits had been considerably reduced and by 1939 it was claimed they had been completely eliminated. Local opinion claims that this was due to disease, predators, or adverse food conditions rather than to the efforts of men. Wild cats, weasels, stoats, and hawks abounded in the region at this time.

In November 1939 the majority of the run was taken back by the Crown for military purposes and the remainder was acquired in 1942. In recent years transmitting and receiv-

ing wireless stations have been set up in the district because of the ideal atmospheric conditions. Recently a licensed aerodrome has been built at the township by Mr. W. R. Harding, one of the larger runholders.

Today the area is subdivided into numerous holdings with grazing licences and there are also freehold runs south and west of the Waiouru township.

Soils

In the Waiouru district the soil pattern depends principally on the kind and depth of volcanic ash at the surface. During the past 10,000 to 20,000 years the district has been repeatedly showered with materials erupted from vents in the National Park and Taupo regions, and deposits more than 3ft. thick occur on all undulating to rolling slopes. The original soil, bush, and scrub were buried deep under the ash showers; carbonised wood can often be seen in roadside cuttings today. Less volcanic ash has been retained on hilly and steep land, and on these slopes soils

WAIOURU TUSSOCK LANDS

In roadside cuttings one can often see carbonised tree trunks buried in pumice.

Land development stages on Mr. W. R. Harding's property at Waiouru. In the foreground is tussock which has had one cut with the discs, in midfield is a large area of swedes, and in the distance is wheat and barley stubble.

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are partially or wholly derived from the underlying sandstones, mudstone, or limestone. A small area of peaty soil near Waiouru Camp has been derived from the accumulation of decomposing vegetation and mineral materials washed off the surrounding land.

The Ash Showers

The volcanic deposits are divided into three series of showers named the Tongariro, Taupo, and Ngauruhoe ash showers, which were laid down in that order. These three showers may be easily distinguished by colour and texture and can be seen clearly in cuttings about the township of Waiouru and on the Desert Road. The 3in. to 12in. of dark grey coarse sand on the surface is the Ngauruhoe ash and it lies on Taupo ash, which consists of dark brown and light grey sand containing pieces of white pumice. Underlying the Taupo ash are the dark grey and red brown, sandy loam layers of the Tongariro ash. Ngauruhoe and Tongariro ash are composed of andesitic materials, whereas Taupo ash is the more siliceous rhyolitic material.

In the valleys about the military camp where the volcanic ash has been washed off the steep slopes there are fairly fertile areas formed from mudstone and limestone. In the upper reaches of the Moawhango Valley the soils are poor, being formed from soft and hard sandstone material, and where the vegetation is depleted erosion is severe.

Tongariro ash occurs on the southern and westerly areas of the district and is typical of the soil of the Ohakune region. Generally it is slightly acid, but is not responsive to lime. Pastures respond well to phosphate and in some areas it is becoming increasingly responsive to potash. Phosphate fixation may be high on this class of soil.

Taupo ash is the most extensive of the ash showers and occupies a huge area extending from near Te Kuiti in the west to Poverty Bay in the east. This shower was laid down by an eruption which occurred probably near the edge of where Lake Taupo is today. The properties of the soil derived from this ash vary with the climate and the nearness of such underlying materials as Tongariro ash or siltstone.

Though the Taupo ash is low in cobalt, the pastures are not deficient in this mineral and stock thrift is good about Waiouru. This is due to the numerous dustings of Ngauruhoe ash which the area has received from eruptions of Mt. Ngauruhoe and Mt. Ruapehu during the last 100 to 200 years.

Ngauruhoe ash is the most recent in origin and the soils are best described as raw soils. The pH of the soils sampled about Waiouru on the Ngauruhoe ash ranges between 5.8 and 6.3, with high available calcium figures. These levels are very satisfactory for plant growth without the addition of further lime.

Phosphates Key to Development

On these volcanic soils spectacular results have been obtained from the use of superphosphate on crops and pastures. Superphosphate is the key to the development of this class of country. This response from superphosphate may be two-fold, as a recent minor element trial by the Department of Agriculture has shown a pasture response to sulphur on the Ngauruhoe ash (Waimarino sand set).

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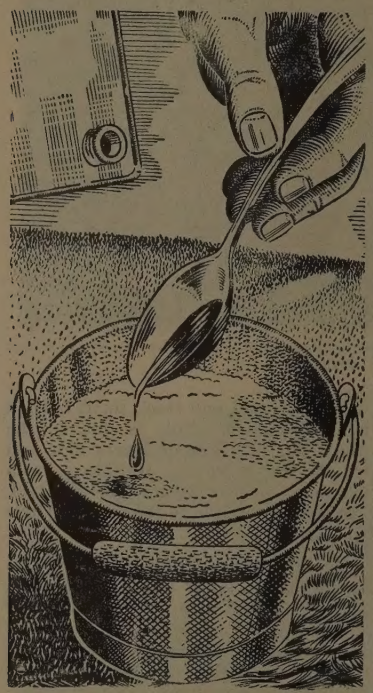

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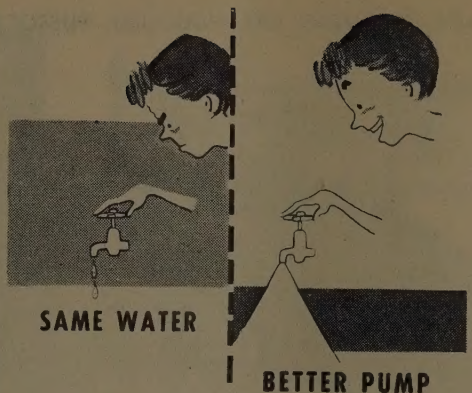

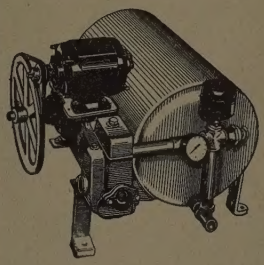

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Topdressing with molybdenum or molybdenised superphosphate is not recommended, because the soils have sufficient molybdenum in an available form. Indiscriminate use of molybdenum could cause thrift problems in stock.

Erosion

The light pumice soils of the area are readily eroded by wind and water when bare. The area is at times subjected to very strong north-westerly winds and wind erosion is a problem on areas where the soil is exposed during summer. Seedling establishment is a problem owing to the difficulty in consolidation and the danger of wind blow. This district includes the headwaters of the streams that flow through the fertile Rangitikei and Whangaehu Valleys. It is, therefore, very important that the whole area should be well covered with vegetation to prevent sudden run-off. Erosion by both wind and water was particularly severe when rabbits and faulty stocking had depleted the tussock lands in the late 1920s. The answer to the erosion problem lies in good farm management practices, especially lenient stock grazing and conscientious pest control.

Climate

Waiouru has a severe climate with a dormant winter growth period of about 5 months. The extreme maximum temperature is about 76 degrees F. and the extreme minimum temperature is about 17 degrees F. There are on an average 123 frosts per year.

An interesting comparison can be made between this region and the Mackenzie Country in the South Island. The altitudes of Waiouru and Lake Tekapo are similar and the mean annual temperature is the same. There is a striking similarity in the nature of the tussock vegetation, though Waiouru has the tall, higher-rainfall type of tussock grasses dominant and the Mackenzie Country the low tussocks. Here the similarity ends, as the soil in the Mackenzie Country is glacial in origin and the area has half the rainfall of Waiouru.

	Mean temperature degrees F.	Mean rainfall in.
Lake Tekapo (2,350ft.)	47	22.53
*Waiouru (2,670ft.) ..	47	44
Karioi (2,125ft.) ..	48.4	48.05

* The Waiouru observations as supplied by the Director, Meteorological Branch of the Air Department, are for 1950-53. They were recorded at the Naval Station.

Shelter Belts

The prevailing wind at Waiouru is a strong north-westerly. The farming land is very exposed, because very few shelter belts have been planted in the past. At Waiouru the most suitable trees to plant are *Pinus murrayana* (lodgepole pine), *P. ponderosa*, and *Chamaecyparis lawsoniana* (Lawson's cypress). Care is necessary in selecting a good strain of tree, especially of the lodgepole pine and *P. ponderosa*. There are sites capable of growing other species such as radiata pine and some of the eucalypts, but these are governed by soil types and the degree of exposure to the prevailing winds.

Land Development

Each year about Waiouru large areas of native tussock are developed. Several modifications of land development methods are practised. Generally, one or two root crops are taken after the tussock has been disced, followed by a cereal crop on the flat areas before sowing down into pasture. Giant discs replace the plough to a large extent because they offer a quicker means of cultivation. The volcanic ash soils are very free draining and this enables cultivation to be done during winter, limited only by heavy falls of snow.

The native tussock land is given a double cut with giant discs in autumn or early winter. The land is left until spring, when it is given a further cut with giant discs and is then worked into a rough seed-bed with a heavy set of harrows. Care is taken to avoid bringing any unrotted tussock to the surface.

Once the seed-bed is ready about 10oz. of swedes are drilled in with 2cwt. to 3cwt. of superphosphate or serpentine superphosphate to the acre. Serpentine superphosphate is a reverted form of phosphate and is a safe fertiliser to use. Straight superphosphate is liable to reduce the seed germination.

When the seed is not too expensive about 4oz. of chou moellier seed is sown with the swedes. The chou moellier, being, tall, has the advantage of standing above the snow, but height can also be a disadvantage in keeping the sheep wet. The most popular varieties of swedes in the district are the early maturing N.Z. Superlative, the mid-season N.Z. Grandmaster, and N.Z. Crimson King. Grandmaster and Crimson King are hardier than Superlative, keep into winter better, and are less liable to soft rot. The swede crop is fed off about June, depending on the season. The area is then fallowed for 18 months to give the tussock ample time to rot. After this period the area is disced in preparation for a soft turnip crop which is drilled in in January at 1lb. per acre. N.Z.

Lodgepole pine (*Pinus murrayana*) forms dense shelter belts, but care must be taken to select a suitable strain.

Californian thistle is becoming a problem on areas where cereal crops are grown.

Green Globe is the popular variety and the most suitable turnip for this district. The turnips are fed off in late autumn and early winter and are usually finished by June.

After the soft turnip crop either a spring-sown cereal is grown on the flat areas or the land is put down in pasture. Oats are the most commonly grown cereal, but sometimes barley or wheat is sown, barley being preferred to wheat because it has a shorter growing season. One of the disadvantages of the oat crop is that adverse weather is usual when the oats are being threshed from the stook. The cereals are sown in September and harvested in February-March. Occasionally an unexpected frost during the flowering stage prevents proper seed formation. Infestation of army worm (*Persectania ewingi*) can also be serious in cereal crops at the milk ripe stage. A recent infestation was successfully controlled by aerial application of DDT emulsion.

In some areas Californian thistle is becoming a problem in cereal crops. The thistle can be eradicated from these crops by spraying with a hormone preparation based on the sodium salt of MCP or the amine salt of 2,4-D. Care must be taken not to spray the cereal before it reaches the tillering stage or after it reaches the boot stage; that is, when the upper sheath is beginning to swell when the seed head is forming.

Pasture Establishment

After the cereal crop the area is prepared for pasture. An autumn discing is followed by a spring cultivation and seed-bed preparation. A firm, fine seed-bed is not the aim on this class of country owing to the danger and problems of wind erosion. A rough seed-bed with clods is desirable to shelter the young plants and to ease the wind blow. Normally a Cambridge roller is not used for consolidation until the pasture is 6in. high. This lack of consolidation and wind erosion are two chief problems of pasture establishment. The grass seed is drilled in with 3cwt. of superphosphate. A mixture found to give good results on this type of country is:—

	Lb. per acre
Perennial ryegrass	20
Cocksfoot	8
White clover	3
Crested dogstail	3
Cowgrass	3
Subterranean clover (½lb. of Mt. Barker, ½lb. of Tallarook) ..	1
	38

In the damper areas 2lb. of timothy are included. At times ½ bushel of oats is sown to give an extra bite of winter feed and help lessen wind erosion.

Modern strains of grasses and clovers play an important role in land development, as they assist in building up the soil fertility by increasing the carrying capacity. The soil is well suited to both red clover and white clover and once vigorous strains are established there is no difficulty in maintaining a well-balanced pasture, provided sufficient fertiliser can be supplied and sensible stocking carried out.

Future Development

Twenty years ago this class of land was a doubtful proposition. Today with the increased use of the aeroplane and heavy machinery the future has become brighter. There are thousands of acres lying undeveloped on the volcanic plateau and if land development and research make as much progress in the next 20 years as they have in the last 20 years, the "Desert" will no doubt have an interesting future.

Acknowledgments

Acknowledgments are made to Messrs. A. G. Bagnall, National Library Service, H. S. Gibbs, Soil Bureau, Department of Scientific and Industrial Research, W. R. Harding, Waiouru, E. A. Peters, Hihitahi, E. C. Stephens, Tangiwai, and the New Zealand Forest Service, Ohakune.

Correct Measurements and Assembly of Hive Equipment Essential

THE 10-frame Langstroth hive is recognised as the standard hive in New Zealand. This bee-spaced, movable frame hive allows the interchange of hive parts and keeps down manufacturing costs. In this article D. A. Briscoe, Apiary Instructor, Department of Agriculture, Tauranga, draws attention to the necessity for accurate measurements and correct assembly for better beekeeping.

DURING the off season much of the beekeepers' time is taken up in the manufacture and assembly of woodware in preparation for the approaching season. All too often this work is hurried, with the result that frames come apart during the season's manipulations and ill-fitting hive parts allow moisture to accumulate in them with detrimental results to the equipment and general comfort of the bees, and subject the colony to much robbing and attacks from wasps. Where beekeepers manufacture their own woodware it is essential that standard measurements be closely adhered to. Near enough is not good enough for the manufacture and assembly of hive parts, and measurements should be checked carefully.

Correct Assembly Important

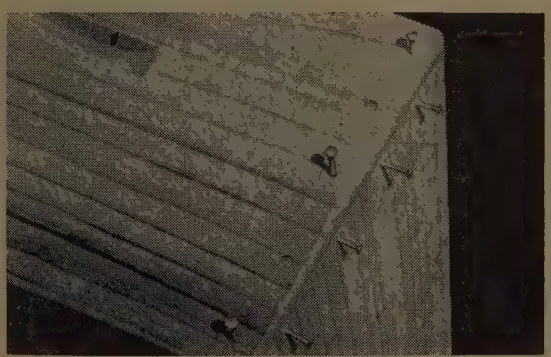
The correct assembling of standard hive equipment is just as important

A well-constructed, tight-fitting hive.

The top bar of a frame coming apart because of incorrect nailing.

Correct method of check-nailing a frame.

A twisted super caused by faulty manufacture and incorrect nailing.



Correct method of check-nailing a super, showing the 5-4 nailing method.

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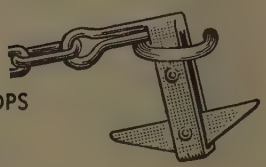
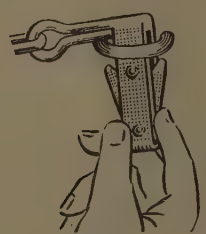


JUST DROPS INTO POSITION



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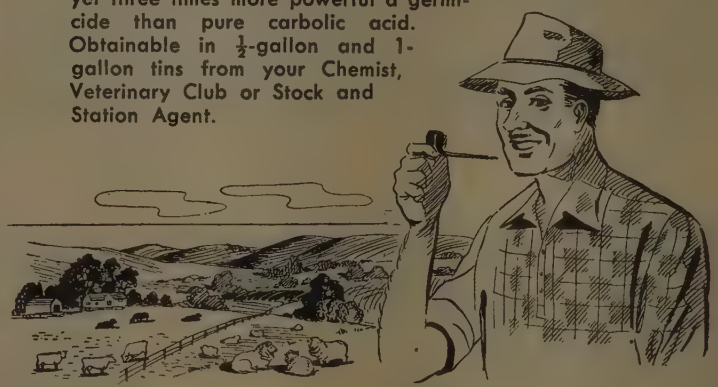


'DETTOL'

THE MODERN ANTISEPTIC

Reckitt & Colman (New Zealand) Ltd., Pharmaceutical Division, Forth Street, Dunedin.

as correct manufacture and this work should be done thoroughly. The small amount of extra time taken to do the job properly may mean saving hours of extra work once the material is put to use in the apiary. Once an appliance has been made up it invariably remains as it has been assembled during the complete period of its usefulness and an ill-fitting super or lid or a badly constructed set of frames can cause much trouble in the apiary as long as such equipment remains in use.

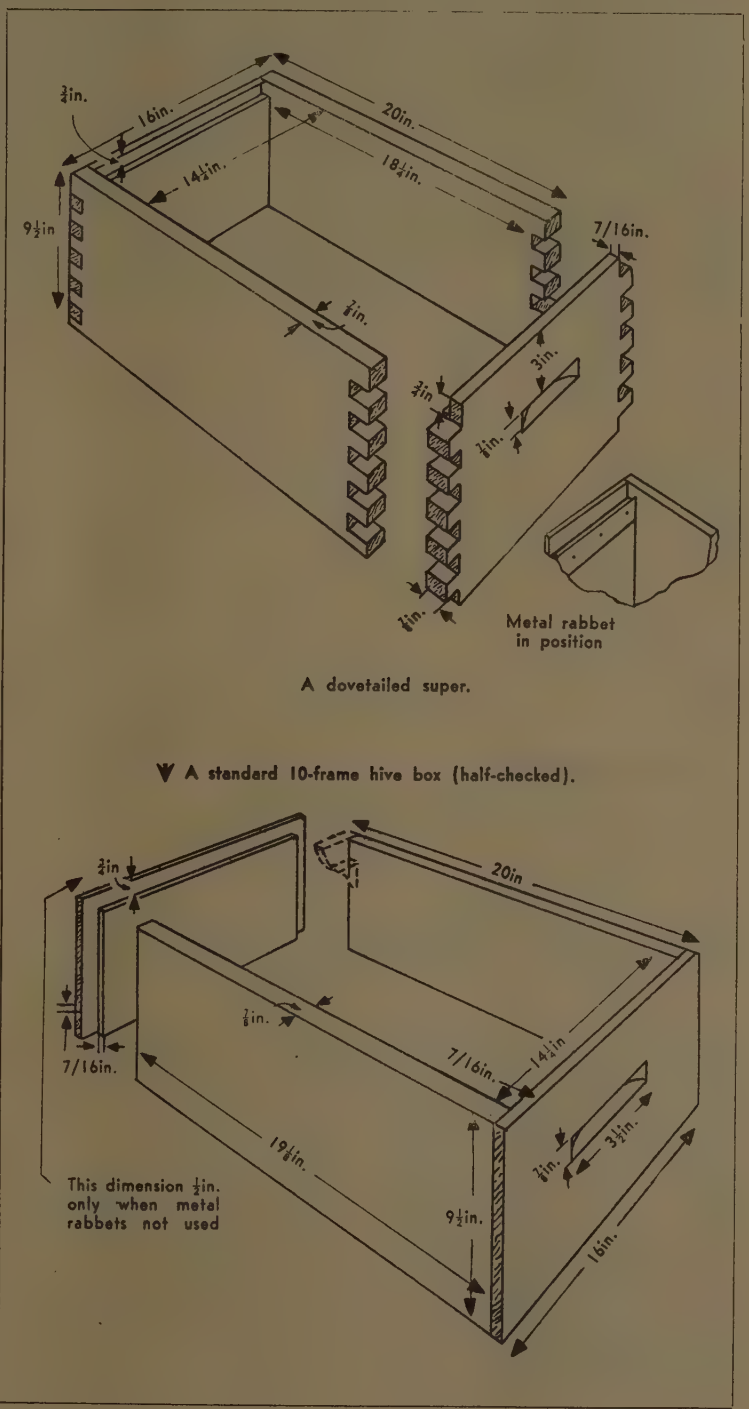
Assembling Frames

When frames are being assembled it is necessary that the correct nails be used. Nails that are too short have not the grip and strength necessary to hold the frame rigid, and invariably it comes apart during constant use. On the other hand, if nails are used that are too big, the complete frame is weakened by the timber splitting. The best nail for the purpose is a flat-headed, cement-washed nail 1½in. long. Two nails (one each end) are sufficient to hold the bottom bar in position, and the top bar should be check-nailed, that is, one nail should be driven through the top bar itself and a further nail driven sideways through the side piece of the frame and into the end of the top bar (see middle-right illustration on page 11). One nail through the top bar is insufficient to hold the frame rigid during use. Invariably after a season or two with manipulation the top bar will come apart from the frame, as shown in the upper-left illustration on page 11). This is also the result if too-small nails are used and if check-nailing is not adopted.

Provided measurements are closely followed, lids and bottom boards should not be difficult to assemble, as these tend to square themselves up as they are put together.

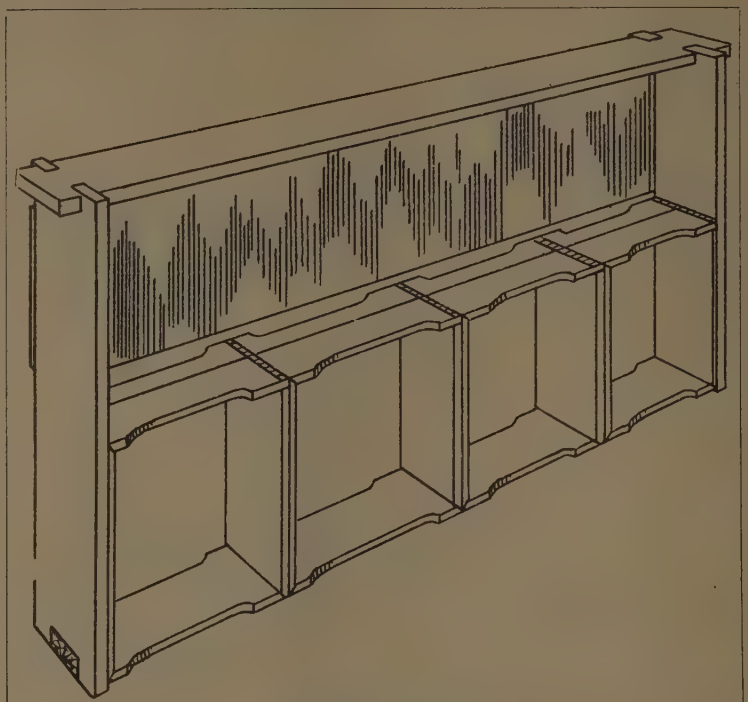
Assembling Supers

Supers, however, require more care when being put together, especially the half-checked type. All too often on completion the super has a twist or wobble when placed on another super or bottom board (see lower-left illustration on page 11). Supers, like frames, are subject to much hard work and care should also be exercised when nailing them, a system of check-nailing similar to that used for frames being used. Cement-coated or galvanised flat-headed 2½in. nails should be used on the 5-4 nailing system, that is, 5 nails on the face of the super and 4 nails, alternately placed to the front nails, on the side of the super (see lower-right illustration on page 11). To begin, super components should merely be tacked together by a single nail in each corner. If measurements have been closely followed, no difficulty should be encountered by



A dovetailed super.

▼ A standard 10-frame hive box (half-checked).



A full-depth section frame.

this means of assembly and the possibility of twist is eliminated.

Sections and Section Frames

With the standard frame section holder it is not possible to check-nail as with the ordinary frame. It is advisable, therefore, to use two 1½in. cement-washed nails in each end for attaching the top bar. An alternative could be to use one such nail at each end and a second ¾in. nail driven through the top edge of the end bar and into the top bar at the place where the top bar is recessed to take the end bar. This acts in much the same way as the ordinary check-nailing and ensures a joint that will not readily pull apart. Two nails should also be used for attaching the bottom bar.

Before sections to be used for section comb honey are folded it is necessary to pour hot water (preferably from a kettle) on the three V joints to prevent the section from breaking. It is also advisable to allow a few minutes for the hot water to penetrate completely the joint before the section is bent into position.

Complete details of all measurements of Langstroth-type standard hive equipment are available from any office of the Department of Agriculture on application. These measurements should be followed by all producers who manufacture and assemble their own hives.

Photographs by Rendell's.

Maintenance of Irrigation Races and Equipment

By B. A. LAUDER,
Research Officer, Department of Agriculture, Winchmore

TIME and money spent on maintenance of irrigation races during the off-season will be repaid many times in increased efficiency of irrigation throughout the coming season. All maintenance work should be completed by the end of September before the start of irrigation with the return of drier conditions.

SILTED and weedy races impede the passage of water and will not carry the full flow, with the result that much water is lost before it actually reaches the paddock. The amount of work involved in removing silt and weed growth is often too great to be undertaken by hand labour. Smaller races can be dealt with by normal farm equipment, but the cleaning of large irrigation races is most conveniently done by a contractor with a suitable ditch-cleaning machine.

Particular attention should be paid to races not accessible to sheep and especially those where the fall is slight. Irrigation races grazed by sheep last season and which will again be grazed by sheep in the coming season should require little attention except in culverts and junctions, but races passing through paddocks not grazed by sheep last season (for example, hay paddocks) and some supply races with low gradients and not accessible to sheep will have a heavy deposit of silt and carry much weed growth.

Such races should be very thoroughly cleaned because these are the main trouble spots in the whole system of races and therefore warrant special attention. Even with thorough mechanical cleaning, however, these sections of the race system will become choked with weeds before the season is far advanced. Weedkillers should be used to control growth on such races.

TCA applied at 100lb. per acre in September can be expected to keep down growth of grass throughout the coming season. This substance is soluble in water and should be applied in solution at about 300 gallons per acre. As TCA is corrosive, protective clothing and goggles should be worn during mixing and spraying. In paddocks not grazed by sheep such as hay paddocks it is very worth while to apply TCA to the ground for a distance of 3ft. or 4ft. on the paddock side of the headgate. The water then has a clear run from the headrace on to the paddock and irrigation is thereby speeded up.

In maintenance work on irrigation races and equipment attention should also be paid to culverts and junctions. All silt and other debris should be cleaned out of culverts, and junctions should be inspected and any leaks below the concrete footings thoroughly repaired.

Sound irrigation frames and canvas sheets are important items. These should be examined and necessary repairs or replacements effected.

Maintenance work on the irrigation system on the lines described can be deferred only at the cost of reduced efficiency of irrigation.

CEREAL TRIALS

THE Extension Division carries out each year a large programme of field trial work to test the value of newly bred varieties and selections made by the Crop Research Division, Department of Scientific and Industrial Research. Results of trials with cereals are discussed in this article.

WHEAT

A WHEAT selection known as 313,01 has for some years now consistently outyielded Cross 7 in both autumn- and spring-sown trials in all localities when they have been compared. The margins of superiority have been substantial. The selection is highly suitable for header harvesting, as it equals Cross 7 in ability to resist lodging and shaking, and is approximately equal in time of maturity. Its one disadvantage—a serious one—has been a distinctly lower baking quality than Cross 7.

An important development in this selection has now occurred, however, for recent work at the Crop Research Division has resulted in some re-selections which appear to be of satisfactory baking quality. These will require testing for agronomic characteristics and will appear in the next series of Extension Division trials.

ARAWA

Another selection of wheat, which has subsequently been named Arawa, has proved to be particularly suitable for the Waimate and North Otago districts. Here for many years Dreadnought has been the main variety grown, but it is not suitable for harvesting by the direct heading method. There has arisen a demand for a replacement variety which could be direct headed but which retained the desirable qualities of Dreadnought which had made it so suitable to the requirements of these districts.

For some years of trials Arawa has given promising results and in the 1955-56 season many large block trial sowings of this new variety were made to compare it with Dreadnought and other varieties used in the district. The results and farmers' opinions were favourable and Arawa appears likely to be an important commercial variety for the heavier wheat soils of South Canterbury and North Otago.

GABO

In the North Island trials with wheat varieties have been continued. Gabo, an Australian variety, has been shown to be a useful replacement for Tainui. Whereas the latter has the disadvantage of becoming lodged easily, Gabo is much more resistant to lodging and it equals Tainui in ability to yield well.

BARLEY

Trials with varieties of malting barley in 1954-55 continued the comparisons of Research, Kenia, and the Kenia-like varieties Herta, Rika, and Maja. In addition two varieties, Carlsburg and Proctor, appeared for the first time. Both of these new varieties are similar in type to Kenia, though Proctor is appreciably later in maturity. Carlsburg performed very promisingly, as it gave outstandingly high yields, but further trial work to confirm these results is required. Research is earlier in maturity than the Kenia group of varieties, though not outstandingly so. It is more inclined to lodge if conditions are conducive to lodging.

OATS

Milford, a British variety which has performed well in recent Extension Division trials, has now gained prominence as a variety for milling purposes. It is notable for its ability to resist lodging while producing high yields of good-quality grain. In Extension Division trials Milford has become the standard against which other varieties and selections under test are judged. In the 1954-55 trials two varieties, Minor and Steel, compared favourably with Milford in yield and agronomic characteristics and they appear to be promising, as were some selections bred at the Crop Research Division. It has therefore been possible to carry out a new type of trial with oat varieties suitable for direct heading, and Milford, Steel, Minor, and the selections all appear suitable for this purpose.

GREENFEED CEREALS

Some special rate of growth measurement trials were conducted during 1954 in an attempt to obtain information on the relative productions of cereal greenfeed varieties at different times of the year. An experimental technique in which the cereals were cut and weighed at regular intervals was used. Production figures were obtained for such periods as the initial period of growth following sowing and the first and second recovery growth periods after cutting. The technique was successful and some interesting data were obtained. As a general rule pairs of varieties of cereal greenfeed were used, as the technique was not suitable for comparing a large number of varieties in a single trial.

The trials demonstrated the suitability of N.I.A.B. ryecorn for providing greenfeed in the latter half of winter, because its powers of recovery after earlier cutting made it superior in this period to Algerian oats, Dun oats, Winter Grey oats, and Black Skinless barley, varieties with which it was compared in various trials. It was by no means the best variety for the production of bulk of earlier greenfeed, generally being inferior in this early period to each of the varieties mentioned.

Wong barley was compared with Cape barley in a North Island trial (Marton). Though Cape barley outyielded it in the earlier periods by a considerable margin, Wong barley was superior in the later months, when it showed good powers of recovery and production. A trial was conducted in South Canterbury to investigate the use of nitrogenous fertilisers on cereal greenfeeds. The trial showed that good results could be obtained from the use of fertiliser nitrogen on cereal greenfeeds and that further work in this direction would be worth while.

—K. COTTIER

Instruction in Dairy Factories is Highly Skilled Work

THE dairy industry of New Zealand is well known overseas and by world standards its factories are large. Yet the years of experience and the large scale of New Zealand butter and cheese production, and manufacture of casein, dried milk, and similar products have not made processing stereotyped. The manufacture of dairy produce is still an art that requires an immense amount of skill and knowledge.

Dairy factory managers have the help of Farm Dairy Instructors in ensuring a high standard in the raw product, milk or cream, but when manufacturing is undertaken the difficulties in handling a product such as milk become apparent. Many other industries use standardised raw materials, such as steel, cloth, and wood, which can be subjected to standardised treatment day after day. This is not so in the dairy industry, and every day's batch of milk or cream may require slightly different treatment. The factory manager must produce a top-grade article which will maintain its quality after shipment overseas and long storage, and New Zealand's dairy factory staffs are strikingly successful in doing this.

Role of Dairy Instructors

Nevertheless even the best managers find that sometimes their produce is down in quality and at this stage the Dairy Instructors of the Department of Agriculture can help them. Dairy Instructors have a wide experience of factory management and the practical work of day-to-day running of a factory. In the course of their duties they gain experience of the manufacturing processes and difficulties of many factories, and become expert at helping to locate the causes of defects in butter and cheese. They assist the factory manager in difficulties and, with him, will examine each step of manufacture and each piece of equipment used until the causes of faulty produce are found.

Practical Experience and Training

During their work Dairy Instructors travel from factory to factory and can thus see new factory equipment at work and can disseminate through the industry the results of the best practices. Dairy Instructors are appointed from the ranks of the Dominion's successful cheese and butter factory managers. Their practical experience and the training they receive in the Dairy Division of the Department combine to make them an invaluable part of New Zealand's dairy industry.

Factory managers interested in instructional work should write to the Director, Dairy Division, Department of Agriculture, P.O. Box 2298, Wellington, or get in touch with their local Dairy Instructor.

Meteorological Records for May

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in Inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	58.7	+ 2.4	74.4	40.1	16.81	24	+ 9.62	3.82	20	86
Auckland	160	58.9	+ 2.3	70.3	44.8	5.35	17	+ 0.56	1.36	28	107
Tauranga	10	57.2	+ 3.6	69.4	39.9	8.72	17	+ 3.59	2.19	27	107
Ruakura	131	55.6	+ 4.2	70.8	31.4	3.73	14	— 0.77	1.03	28	111
Rotorua	975	53.8	+ 3.6	66.9	34.2	11.55	13	+ 6.27	3.38	28	96
Gisborne	12	57.2	+ 4.3	70.8	40.7	7.11	22	+ 2.34	2.90	31	59
New Plymouth	160	56.3	+ 2.6	70.5	41.0	7.80	12	+ 1.73	1.81	29	135
Karioi	2125			68.0		5.34	14	+ 1.32	2.61	14	
Napier	5	56.0	+ 3.2	75.8	38.2	6.55	23	+ 3.21	2.16	31	71
Wanganui	72	54.4	+ 1.4	75.6	39.4	2.43	14	— 0.69	1.05	14	121
Palmerston North	110	54.8	+ 3.8	70.4	34.8	3.31	17	— 0.01	1.36	14	112
Waingawa	340	52.1	+ 2.6	70.3	34.0	3.10	21	— 0.95	0.58	29	59
Wellington	415	53.1	+ 1.8	70.6	42.5	7.45	22	+ 2.89	1.75	29	97
Nelson airfield	5	50.8	+ 2.3	65.2	30.0	7.41	11	+ 4.37	2.78	21	146
Blenheim	12	50.8	+ 1.2	69.1	29.3	4.66	15	+ 2.13	1.61	29	117
Hokitika	15	51.7	+ 3.5	71.0	30.6	6.63	16	— 2.65	1.69	27	164
Hanmer	1270	44.2	— 0.6	67.0	25.0	4.43	15	— 0.05	1.35	22	82
Christchurch	22	48.0	+ 0.4	71.2	29.9	2.56	17	— 0.29	0.79	14	101
Ashburton	323	46.0	— 0.7	68.8	27.6	3.20	14	+ 0.65	0.87	28	102
Timaru	56	46.2	— 0.6	61.0	30.3	3.45	15	+ 1.92	1.03	28	94
Alexandra	520	41.6	— 1.3	66.8	22.2	2.67	11	+ 1.76	0.80	13	118
Taieri	80	45.4	— 0.5	67.5	25.9	6.91	13	+ 4.82	1.94	29	114
Invercargill airfield	0	43.8	— 1.5	65.2	22.5	1.93	12	— 1.81	0.48	13	123
Chatham Islands	140	51.1	+ 0.5	60.6	32.2	1.98	14	— 1.47	0.38	6	

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during May and for the 10 months ended 31 May 1956, with comparative figures for the same month and 10 months of 1954-55, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc. or dec.
May 1956	3,817	157	3,974	—
May 1955	2,282	102	2,384	—
Increase or decrease	+1,535	+55	+1,590	+66.694
10 months ended 31/5/56	159,355	2,936	162,291	—
10 months ended 31/5/55	146,689	2,980	149,669	—
Increase or decrease	+12,666	—44	+12,622	+8.433

Butter in store at 31 May 1956 was 30,374 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
May 1956	5,451	—	5,451	—
May 1955	2,995	775	3,770	—
Increase or decrease	+2,456	—775	+1,681	+44.58
10 months ended 31/5/56	77,918	12,702	90,620	—
10 months ended 31/5/55	76,288	20,556	96,844	—
Increase or decrease	+1,630	—7,854	—6,224	—6.427

Cheese in store at 31 May 1956 was 25,555 tons

If these figures are converted into butterfat equivalent, there is an increase of 5.079 per cent. in butterfat graded for the 10 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

What to Plant

WHETHER from force of circumstances or from lack of imagination or of a venturesome spirit most farmers when choosing species of trees to plant decide on radiata pine (*Pinus radiata*). This ubiquitous species is so easy to raise and to transplant, so tolerant of site, and so rapid in growth that its popularity is scarcely to be wondered at. However, there are many other trees especially suitable for certain sites and whose timber is valuable for certain purposes. Some notes on these other species are given here by W. H. Jolliffe, Extension Forestry Officer, New Zealand Forest Service, so that a wider choice will be available to the reader.

IN the June issue of the "Journal" broad consideration was given to trees for certain purposes, but in all cases the species chosen must be capable of thriving in the particular site where they are to grow. Site conditions which affect the choice of species are:—

Altitude and topography: The upper limit of effective tree growth in New Zealand is between 2000ft. and 2500ft. Species which do best in high country are larch, *Pinus murrayana*, and spruce (provided the air is moist). Most trees prefer sloping ground and such a site is imperative for the healthy growth of larch.

Aspect means the lie of the ground in relation to the sun; the reaction of certain species to aspect varies between the northern and southern extremities of New Zealand. For example, Douglas fir and larch prefer a southerly aspect (except in the south of the South Island) and most pines do best on a northerly one.

Soil: For trees soil fertility is not as important as its physical condition. Extreme acidity or alkalinity, good or poor drainage, soil texture, and the presence of a hard pan near the surface all markedly affect the choice of species. No trees will flourish where drainage is poor or where there is a hard pan, but some such as poplars, alders, willows, and swamp cypress (*Taxodium distichum*) are more tolerant than others, provided the pan is not too close to the surface. Cedars and *Casuarina* survive on dry sites and oak, ash, and redwood require good, well-drained soils.

Climate: Abnormal climatic factors strongly influence the choice of species. For instance, most pines are badly damaged where snowfalls are heavy, whereas larch, spruce, or Douglas fir suffer little damage, and in fact larch and spruce thrive on hard winters. Many species are sensitive when young, requiring some shade or shelter, but are quite hardy later. Tree lucerne is a good nurse in many cases. In frost hollows *Pinus ponderosa*, *Pinus murrayana*, *Pinus laricio*, poplars, and *Robinia pseudacacia* give the best chance of success. Gale-force winds retard tree growth and, if salt laden, are definitely harmful to most species except macrocarpa, radiata and Corsican pines, *Robinia*, *Eucalyptus botryoides*, and silver poplar.

Vegetative cover: Where scrub growth is vigorous a fast-growing species should be chosen and large planting stock used. Slow-growing trees and the use of small stock in such places will mean that for years overhanging growth will need to be cut back.

Muricata pine (blue variety) in North Canterbury. The tree being measured has a diameter of 28in. at 49 years old.

Recommended Trees

The following species are recommended for use in farm planting in New Zealand.

Californian big tree (*Sequoia gigantea*) is suitable for moist, low-lying sites. It grows large and has pronounced taper unless grown in fairly dense groups. The timber is soft and brittle, but the heartwood can be used for weatherboards and sash timber.

Cedars (*Cedrus* spp.) is suitable for drier sites. The tree is slow growing and prefers some initial shelter. The timber has fragrant, durable heartwood and is a good general-purpose timber in the species' native countries, but is not yet well known in New Zealand.

Corsican pine (*Pinus laricio*) has shown a wide tolerance of latitude, altitude, and site in New Zealand. It has been successful from Waipoua to Southland and is perhaps at its best at Hanmer Springs. It is slower growing than most pines. The timber is denser than in trees such as radiata and is suitable for flooring and general building, but requires preservative treatment against decay and antisapstain dip to avoid discoloration during seasoning.

Cryptomeria (*Cryptomeria japonica*) is also known as Japanese cedar. It makes a very slow start in the open and is more suitable for underplanting cut-over bush or under open-grown exotics. Two-year stock should be planted. The timber is valuable in Japan, but is little known yet in New Zealand.

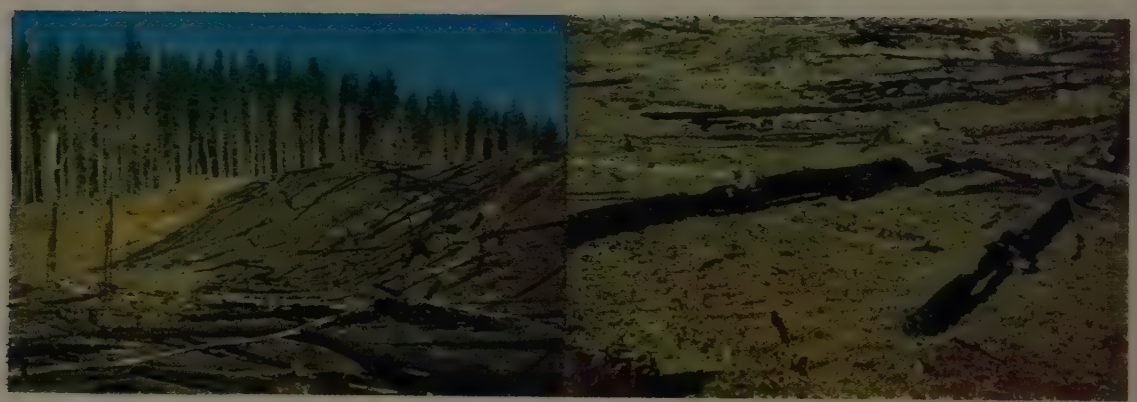
Douglas fir (*Pseudotsuga taxifolia*): The timber trade name for this tree is Oregon pine. The tree has done well on pumice plains near Rotorua and on foothill country south of there, including the South Island. It is not successful in Auckland Province or on

Macrocarpa trees in South Canterbury. The diameter is 31in. at 65 years of age. The branch scars persist only in the bark.

Book Review

Land Development

← The tree was felled 8 years ago. In a few more years the stump will be an easy prey to giant discs or harrows.



▲ Left—An excellent burn obtained in late summer 1955. The fire-break is visible in the left middle distance. Right—New pasture 3 months after aerial sowing late in March.

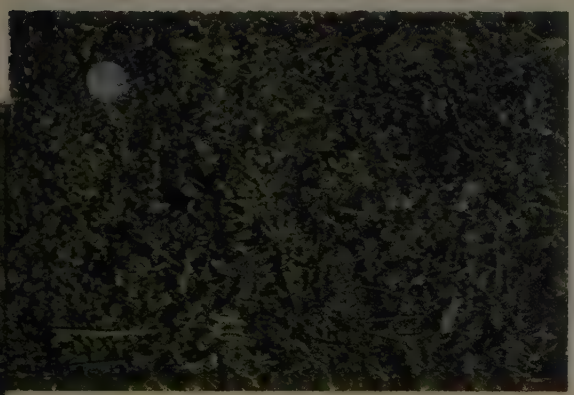
← Tauhinu appears troublesome on this 1-year-old pasture, but it will soon succumb to crushing and grazing by cattle in winter. Vigorous pastures allow this weed no opportunity to spread.

on Cut-over Pine Forests at Tokoroa

By B. A. GUNNING,
Instructor in Agriculture, Department of Agriculture, Matamata

▲ A general view of the area. In the distance is the airstrip. The pasture in the foreground has been down for 3 years.

▼ Pastures are notably clover dominant, as is shown by this 2-year-old pasture.



← Regrowth pine trees in this 1-year-old pasture are a serious threat. Unless cattle are forced to eat them out, they will necessitate heavy costs for hand cutting.

▼ This pasture is 3 years old; the forest has been felled 8 years. There are evident signs of decomposition in the litter.

ON the Central Plateau of the North Island there has been disagreement between those who advocate the establishment of pine forests and those who wish the land to be developed for farming. Thousands of acres, including the Kaingaroa Forest, reputed to be the largest man-made forest in the world, have been planted in pines. The discovery that bush sickness in this area was due to a soil deficiency of cobalt has caused the emphasis to change in favour of pasture, and though pine planting is now more or less at a standstill, over 20,000 acres of grass are being established every year. It is possible that as some of the forest areas are cut over some of the land will be used for farming. This article describes the conversion of pine forest land to pasture which is being done on one area by Mr. M. Alexander, managing director of the Land Development Company, Lichfield Lands Incorporated. The lessons learnt from this example should be of value in other areas.

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It is important that Certified seed only be sown. The use of a bush burn mixture would probably mean that insufficient pasture growth would be obtained from the poor strains of pasture plants to enable the necessary stock numbers to be carried to control the second growth which appears in the first winter.

It is not thought worth while to include other grass species in this mixture, as the above, with poorer species already present and establishing as volunteers, gives good early ground cover. The area is of potential high production and fertility and it is necessary only to introduce the higher - fertility - demanding and higher-producing species of pasture plants. In the early stages clovers are all-important. The loose, light soil will not hold ryegrass well until phosphate and potash have stimulated the clovers to build the nitrogen level of the soil and stock have provided the necessary consolidation.

Until the ryegrass does become dominant other volunteer, poorer species take its place. Browntop, sweet vernal, crested dogstail, *Poa pratensis*, and *Poa trivialis* were present before the burn and persist as major components of the sward, especially where the burn is incomplete. Cocksfoot generally does well on the pumice area and enters the sward as a volunteer. Under the hard sheep grazing necessary to control inferior growth in the early stages of development, however, cocksfoot is not so persistent and this fact coupled with the fairly low initial fertility on this area may be the reason for the absence of cocksfoot in the pasture. Timothy never does well in this region and for that reason is not included in the mixture. Montgomery red clover is used instead of cowgrass. The former is more persistent than cowgrass and also extends the growing season later into autumn. Even so, red clover has not done as well as was expected on these pastures, probably because of the fairly hard grazing necessary to control second growth. Little of it was to be seen on the 3-year-old pastures; after 2 years it appears to fail rapidly. After the initial development stage, when grazing is more lenient, both red clover and cocksfoot will probably persist in the pasture. Paspalum will not thrive in this region because of the cold winter.

After the seed has been sown, and as soon as the aerial topdressing can be arranged, 3cwt. of superphosphate is sown from the air. It is not considered necessary to sow the fertiliser with the seed, as the surface fertility is sufficient to support pasture growth for some time, but it should be sown as soon as convenient in the same autumn. The following spring a further 3cwt. is sown, and thereafter the area receives 3cwt. of superphosphate per acre annually. Cobaltised superphosphate is used to prevent bush sickness. In future potash also will have to be used, as this soil type gives an early response to potassic fertilisers.

When examined in May 1955, just 3 years after the original sowing, this pasture showed signs of grass-grub attack. Patches of the pasture of varying size, mainly on the sidelings, had died and thinned and the desirable grasses were replaced by flat weeds, sorrel, and other weeds. This is very typical of the pumice soils, where grass-grub often appears about the third year after the pasture is sown and attacks first the sidelings where consolidation is incomplete. If left at this stage, the grub spreads in the next season and will destroy large areas of pasture, necessitating ploughing and resowing.

It will thus be necessary to topdress these pastures with 2lb. per acre of 100 per cent. DDT powder. This will give immunity from grass-grub attack for 2 to 3 years, after which consolidation should be sufficient to reduce the risk of serious attacks.

Subsequent to the first burn an area has been cleared, burnt, and sown each year. At present 1100 acres are in grass, being developed at the following rate:—

		Acres
1952	..	260
1953	..	120
1954	..	450
1955	..	270
		1,100

With each burn something has been learnt and the technique improved.

The second burn, of 120 acres, was cleaner than the first, and the pasture is correspondingly cleaner. The burning of 450 acres in the third year was carried out a few months after the felling of the timber, before the branches had lost their leaves. Here a hot, clean fire was achieved and an excellent pasture strike obtained. Some of this burn was carried out in the autumn and some in the spring of 1954.

It was discovered by this time also that the best time to sow in autumn is in late March or early April. Sowing earlier than this may mean that the seed will lie a long time before germinating, as owing to the light, unconsolidated nature of the soil at this stage, the surface dries out very readily. Most success has been obtained where a dry spell at the end of March has allowed a good, clean burn and where seed broadcast by air on this burn has been covered early by warm autumn rains. These were the conditions in the autumn of 1955, when 270 acres were treated under the best conditions so far. The burn was the cleanest yet obtained and the seed established well and promises to yield a pasture superior to that on the other areas.

It is the aim to farm the land by stocking and spreading fertilisers from the air until the pine stumps and logs rot sufficiently to be ploughed into the soil. When this time arrives, the plough will be put into the soil for the first time and paddocks will be ploughed roughly in the order in which the forest was felled off them. In this way the paddocks will eventually be levelled and sown to first-class pasture. On the oldest part of the farm the bush has been felled for only 8 years, yet even now, most of the stumps are loose in the ground and it is possible to break many of them with the heel of a boot. By the time it is possible to plough, these pastures will have been stocked for perhaps 10 to 15 years and will be capable of holding first-class ryegrass, cocksfoot, white clover pastures, provided topdressing is adequate, and will be carrying 3 to 4 ewes per acre.

Subdivision

Hand in hand with the sowing and manuring of the pastures go the stock management and grazing of them. These in turn are tied up with the fencing and water reticulation. As soon as an area is burnt, sown, and manured work is begun on fencing it off so that stock can be used to control growth on the area as it comes away. Where convenient the aim is to fence the area into 150-acre blocks in the meantime. Already 10 to 11 miles of fencing have been erected. These fences are placed with regard to the ultimate layout of the farm and are permanent seven-wire fences with four posts to the chain. Heart matai battens are generally used. Posts range from concrete to totara and treated pine. The last-named are cut off the property from the forest debris and provide a relatively cheap source of quite satisfactory fencing material to farmers developing this class of land. A large portion of the fencing costs is taken up in clearing a fenceline through the forest debris by bulldozer.

On its southern boundary the block is flanked by a stream, but the cliffs which fall down to it are not negotiable by stock. Good water is also obtainable readily from bores, one of which is already serving 11 troughs. In the final plan there will be need of considerable extension to this skeleton watering system.

Stock Numbers

Stock numbers have grown as the grazing area has increased. In the first winter, with 260 acres sown, 100 Rom-

ney ewes were carried. Numbers are increased by saving ewe lambs and by buying in Romney ewe lambs. Stock numbers and the area in pasture are shown in the following table.

Year	Area in pasture (acres)	Ewes	Hoggets	Cattle Autumn	Cattle Spring
1952-53	260	100			
1953-54	380	200	500	60	60
1954-55	830	550	1050	250	380
1955-56	1100	1100	1400	100	250

Steers are used, as these can be done harder than breeding cattle, a necessary factor in the early establishment of this country. Later, when the early development stage is over, a herd of breeding cattle will be carried.

Management of New Pastures

After being sown in March or April the grasses come away and by May or June are 2in. high. Ewe hoggets are then grazed on the fresh growth to keep the pasture in check. Hoggets do extremely well on this feed, and there is no hogget rearing problem on this farm, it being unnecessary to drench. By July or August much second growth fern, tauhinu, heather, and young pine trees have appeared. The first three of these are no real problem and soon die out with rising fertility and crushing with cattle. However, the profuse and vigorous growth of pine seedlings is the main problem at this stage, and the only real corrective is to stock heavily with cattle until they are forced to eat the seedlings out. If the health of the animals is impaired, they are returned to established pastures to recuperate and then returned to the new pastures. Failure to make the cattle clean out the pine seedlings at this stage means heavy labour costs for hand cutting later when the trees have got beyond the grazing stage.

Control of scrub growth by cattle would be relatively easy were it not for the profuse growth of ragwort which appears on new pastures in this area. Because of this weed sheep numbers must be kept at a maximum in the early stages. This means that cattle numbers must be reduced. In practice a careful balance must be maintained between sheep and cattle grazing to suppress both types of weeds, and experience is necessary in arranging the grazing of each area to achieve this.

To get a good clean-up of second growth by cattle it is necessary to concentrate them at about 2 per acre. Introduction of cattle is left as late as possible to get the pasture well established first. After the cattle have cleaned up the second growth, as they usually do by October, the clover comes away and the pasture is leniently grazed with hoggets in spring and spelled in summer to allow reseeding of the ryegrass. Roughage is then cleaned up by the cattle in autumn, in readiness for spring growth.

One fairly prevalent weed on the property that is not controlled by stock is blackberry. This usually appears as large, isolated clumps which are crushed with the blade in January and burnt in February. To control the small blackberry plants coming away in the shelter of logs and other rubbish 200 goats have been introduced. These are beginning to ringbark the young pines as well as attack the blackberry and it is hoped that they may partly take the place of the cattle.

Winter Feeding of Stock

On raw, unconsolidated pumice land ryegrass does not thrive. Consequently, though it establishes well from sowing and persists in the sward, it does not compete vigorously until clovers and stock trampling have improved the fertility and consolidation of the soil. This improvement takes several years to accomplish. Clover, conversely, does extremely well on unconsolidated pumice provided it is fed with sufficient phosphate and potash, and it is thus easy to understand why pastures on this farm are clover dominant in the present stage of development. An important result of this, coupled with the hard winters prevailing in the region, is that pastures cannot be relied on to yield much late autumn, winter, and early spring feed. When the ryegrass content of the sward has been increased, this will be rectified, but in the meantime it appears desirable to provide some form of supplementary winter feed. The standing forest supports a vigorous undergrowth of native and exotic species, grasses, and herbs, and it has been the practice to run cattle in the plantation during early winter before they are required for grazing the new pastures in July. Cattle apparently do well on this feed.

For sheep it appears desirable to grow a crop for wintering. An attempt was made to grow a crop of swedes in 1954 for the first time. An area of 50 acres was cleared of logs by two bulldozers. Stumps were left in place. The area was then cultivated with a set of super giant discs and swede seed was sown from the air with 2½cwt. of superphosphate and 1½cwt. of blood and bone per acre. Germination was not good and the crop was weedy and patchy. In future, cropping will be tried on smaller areas which will be more perfectly cleared, and the seed will be drilled.

General Stock Management

The poor growth of clovers during winter precludes the possibility of early lambing of ewes. Tupping is thus begun in mid-March so that ample feed is available at lambing time. Romney rams are used and lambing percentages are about 105. The presence of charred logs and branches and patches of blackberry also modifies management, necessitating fairly frequent shearing. Normally shearing is done at 8-month intervals, in January, September, and May.

In spite of the hazard of logs and stumps, sheep do extremely well on the fresh, new pastures. Romney wether lambs sold fat are never below 38lb. Ewes grow large, yet their fat cover is very even and they are very active. This is probably due to the extra exercise involved in negotiating stumps and logs. Ewe hoggets are given the chance of breeding in their first autumn. This practice helps to provide part of the necessary rapid increase in ewe numbers and also prevents the larger ewe lambs (which in practice are the only ones which take the ram) becoming too gross.

Costs of Development

It is difficult at this stage to assess accurately the ultimate cost of developing this 3672-acre block to its potential of 5 ewes per acre. There is, however, no doubt that development is being done very cheaply. By this method large areas can be handled with a very small labour force and the only machinery used is a tracklaying tractor to prepare fire breaks, a few cropping implements, and an aeroplane. In future it is probable that larger areas each year will be made available, since the felling of the forest has been speeded up. To secure a good burn it is essential that the timber be burnt within 6 months of felling and for this reason it is necessary for the development to keep up with the rate of felling. This would not be possible if the area had to be stumped before it was sown.

The Government valuation of this particular block in the undeveloped state is £8 10s. per acre. Grassing has cost £9 per acre, this cost being apportioned as follows:—

	£
20lb. of seed ..	5
Fertiliser ..	3
Aeroplane ..	1
Total	9

The cost of the land grassed, but with no other improvements, is thus £17 10s. per acre.

Further costs will be for fencing, water reticulation, farm buildings, and housing, and these costs will vary considerably according to the use of the land, the size of the block, etc. For this large block intended for fat lamb farming it is estimated that the total cost will be less than £30 per acre. Established pastures will carry about 3 ewes per acre. Development to the 5-ewe-per-acre stage will be achieved after ploughing and resowing of pasture.

Importance of Food Factors in Feeding Laying Birds

By S. G. HADDON,
Poultry Instructor, Department of Agriculture, Auckland

POULTRY keepers generally do not know as much as they should concerning foods and feeding for poultry. Years ago, before the high extraction rate of flour was introduced into the milling industry and before the time when it was important to squeeze every egg possible from the layers, the quality of bran and pollard obtained was sufficient to give reasonable egg production when these foods were supplemented with a small amount of meat meal.

THESE conditions no longer exist for several reasons which need not be discussed here. It is sufficient to recognise the fact and to act accordingly.

In order to do so the poultry keeper must know something about the foods he uses and **why** he uses them. If he knows this, it is straightforward reasoning to know **how** to use them.

Carbohydrates, Fats, and Proteins

All foods contain one or more of the three main classes of nutrients, carbohydrates, fats, and proteins.

Carbohydrates and fats are sources of heat and energy. They are the fire and steam in the factory boiler, as it were.

Protein is the raw material which supports growth and is the basic ingredient of the animal output whether it is meat, milk, or eggs.

Throughout the world energy foods are abundant and protein-rich foods are scarce. This means that nearly all foods available to the poultry keeper are in the carbohydrate and fats class; that is, they are good sources of energy, but do not supply sufficient protein for even reasonable egg production.

This deficiency of protein in widespread and commonly used foods must be overcome by adding protein-rich foods. Fortunately New Zealand is one of the few countries which has a large output of protein-rich by-products. These are the meat meals (including meat and bone meal) and the milk powders (skimmed-milk powder and buttermilk powder). Of course these foods contain other things than protein such as fats and carbohydrates, in the same way that energy foods have a small amount of protein in them, though it is not enough to alter the over-all picture.

Vitamins

A ration containing carbohydrates, fats, and proteins in the correct amounts could still fail to give satisfactory results because another class of food factor is now involved. This is the vitamin group. There are several vitamins, but with the type of food in use in New Zealand and the methods of feeding employed it is necessary only to consider a few of them.

For maximum results poultry must be provided with balanced rations, including proteins, vitamins, and minerals.

A vitamin is a dietary essential required in small amounts. But note the word "essential". Vitamins are just that—essential. Without them the living body cannot make use of the food it takes in, suffers from malnutrition, and soon dies.

Vitamin A

The most important vitamin in poultry feeding is vitamin A. This is the active principle of cod liver oil, which is still a basic source of supply of this vitamin, though modern technology has now made available all the vitamin A present in shark liver oil. Fish liver oils are prepared in this country and are marketed under several brands containing specified amounts of vitamin A. Several recognised symptoms indicate vitamin A deficiency, but they will not be listed here. The important thing, of course, is to make certain enough vitamin A is used.

Vitamin D

Next in importance is vitamin D, the anti-rachitic factor. There is a definite ratio between the amounts of these two vitamins required and this is taken care of in the manufacture of the vitamin A oil. It has been found possible to add a vitamin D concentrate to the vitamin A oil. So now when vitamin A is fed at the correct levels for poultry vitamin D is also supplied.

A word of warning is required here. Vitamin D is easily manufactured and is available in many synthetic forms. Only two forms should be used for poultry—the natural D in fish oils and the synthetic form known as D_3, which is, or should be, labelled specifically for feeding poultry.

Vitamin B Group

The vitamins of the B group complete the list of essential vitamins which must be added to the ration. Milk and milk by-products appear adequate for this purpose as far as laying rations are concerned, but in doubtful cases it is possible to add synthetic riboflavin to the ration. When a normal ration is used it does not appear necessary to add extra vitamins other than those already mentioned to the food.

Minerals

Closely linked with poultry's essential need for vitamins is the need for minerals. These are required in varying amounts for a wide range of purposes. They are essential for the correct functioning of the body fluids, including the blood stream, and of course the skeleton would disintegrate without comparatively large amounts of calcium and phosphorus.

As with the vitamins, though, minerals are largely taken care of by the normal rations used in New Zealand. The exception is in the amounts of calcium, phosphorus, and salt required by poultry. These are required in larger quantities than the normal ration can supply. Salt is added in amounts not exceeding 1 per cent. of the total ration and shell grit (or calcium carbonate) is fed ad lib. These additions are all that are required on the mineral side of the ration. Steamed bone flour can be

added, but is not essential. Shell grit is better than agricultural lime because of its phosphorus and other mineral content.

Birds which have access to shell grit only, and to no other form of grit, will eat large amounts of it. If they have access to a hard, insoluble grit (such as fine blue road metal), the amount of shell grit eaten will fall sharply.

There is a sound reason for this. The correct functioning of a bird's gizzard (a strong grinding organ) depends on the presence of grit to act as the grinding agent. Shell grit is not hard enough for this and is rapidly used up (as well as actually absorbed by the bird). On the other hand hard grit is not absorbed but is only gradually worn down and intermittently replaced by the bird. It is therefore sound economics as well as sound feeding practice to keep both shell grit and a hard, insoluble grit in front of the birds at all times. From the foregoing it should be obvious that there cannot be a satisfactory dual-purpose grit in spite of what advertisements may say. If grit is readily soluble, as it must be for adequate calcium intake, it is not hard enough or durable enough to act as a good grinding agent. Conversely the good grinding agent is too hard and insoluble to be a ready supply of calcium. Therefore both types of grit should be kept in front of the birds at all times.

Poultry Mashes

There is no difficulty in making use of the above information. Many of the mash mixers put out so-called "complete" or "vitaminised" mashes often distinguished by coloured labels. The label colour is not important; the list of ingredients and the chemical analysis printed on the label are.

A good laying mash should contain 18 to 20 per cent. protein—not meat meal, but protein. Most of the mashes on the market vary between a content of 16 to 18 per cent. protein. So-called No. 1 mashes contain meat meal, but the protein content is not likely to be much over 16 per cent. A No. 2 mash will not contain meat meal and its protein is probably 11 to 13 per cent. In both cases the protein content is too low for good results. This must be remedied by the addition of protein, but most people have only a vague idea of how much protein is required.

Adding 18lb. of meat meal to 100lb. of average No. 2 laying mash should bring the protein content up to a satisfactory level. A No. 1 mash with meat meal already in it can have more meat meal added, and 8lb. to 10lb. of meat meal can turn a protein-deficient mash into a reasonably good one. Dried skimmed-milk powder and buttermilk powder, though predominantly protein supplements, contain many other useful ingredients not found in meat meal, including some of the important vitamin B group. Cost will limit the amount of milk powder which can be used, but replacing some of the added meat meal with skimmed-milk or buttermilk powder is a sound step.

TABLE 1—MASHES WITH PROTEIN CONTENTS AND QUANTITIES OF MEAT MEAL AND MILK POWDERS TO BE ADDED*

Mash	Protein content as shown on sack labels	Meat meal to be added to each 100lb. of mash	Milk powder or buttermilk powder to replace equal weight of meat meal
	Per cent.	lb.	lb.
High-protein mash	18	—	2
No. 1	16	10	4
No. 2	13	15	3
No. 2	12	18	3
No. 2	11	20	2

* Where mash is put up into sacks and bags which weigh more or less than 100lb. the meat meal additions should be increased or decreased proportionately.

Therefore, up to 5lb. of the 18lb. of meat meal added to the No. 2 mash could be replaced with milk powder, and 2lb. or 3lb. of meat meal could be replaced with milk powder when a No. 1 mash is fortified.

For people who doubt their ability to make these additions correctly or who lack the facilities for doing so a sound method is to keep a box of meat meal or a mixture of meat meal and milk powder in front of the birds at all times. Contrary to expectations, the birds will not gorge themselves on it.

Vitamins, the importance of which has been stressed, are not quite so easy to supply as proteins. As stated, it is possible to buy mashes with the vitamins (mainly synthetic) already added. The success of these mashes depends on two things, both out of the buyer's control. One is the amount of vitamin added and the second is the thoroughness of the mixing. Experience has shown that it may be wiser for the buyer to add the vitamin himself and thus **know** what has been added. It is not difficult and can be done in one of two ways—either by adding vitamin to **all** the mash used at a specified level, or by feeding a definite amount of vitamin oil daily, the amount depending on the number of birds being fed.

Vitamin A and vitamin D content of fish liver oil is standardised, that of vitamin A being 2000 units per gramme of oil. There are other strengths, but this is the commonly used one. With oil of this strength ¾ pint is added to each 100lb. of mash, irrespective of how the mash is used. This should supply sufficient vitamin A and vitamin D for the flock where mash and grain in roughly equal weights are fed daily.

The second method is to feed the vitamin oil at the rate of 1½oz. per 100 birds daily. This amount of oil can be added daily to a small wet mash or, easiest of all, rubbed into the daily grain ration. It will not spoil the grain or make it too sticky for scratch feeding. Vitamin A emulsions (at 5000 units of vitamin A per gramme) which mix readily with water are available and are ideal for mixing with wet mashes. Some people even contend that adding these emulsions to the drinking water is satisfactory. This is debatable, however, and should not be relied on.

To summarise the above information into a ready reference form the following tables are provided.

Table 1 shows protein contents of mashes and the quantities of meat meal and milk powder which should be added. Thus 100lb. of No. 2 mash with a protein content of 12 per cent. needs 18lb. of meat meal or 15lb. of meat meal and 3lb. of skimmed-milk powder.

Table 2 lists the amounts of vitamin A oil to be mixed with various weights of mash to give a satisfactory vitamin content, if about equal weights of mash and grain are fed daily. If a preponderance of grain is fed, use Table 3. In both cases the amounts are based on an oil containing 2000 units of vitamin A per gramme. Do not mix up more mash than can be used in 6 or 7 days. The oil in the mixed mash loses its vitamin content rapidly after the first week.

TABLE 2—VITAMIN A OIL TO BE MIXED WITH MASH IN A 50-50 MASH-GRAIN RATION

Weight of mash	Vitamin A oil (1 pint = 20oz.)
lb.	fl. oz.
100	15 (¾ pint)
50	8 (just under ½ pint)
20	4
10	2
5	1

Of course, irrespective of the method of feeding many people will find Table 3 very convenient, as the birds' daily quota of vitamin A can be given in any small amount of food (mash or grain) at any convenient time during the day.

TABLE 3—AMOUNT OF OIL REQUIRED DAILY FOR BIRDS ON A PREDOMINANTLY GRAIN RATION

No. of birds	Weight of oil daily
	oz.
100	1½
50	¾
25	⅜ (2 teaspoons)
12	¼ (1 teaspoon)

An article of this nature cannot be complete without mention of green food. Poultry keepers should use freshly growing green food, as it contains proteins, minerals, vitamins of the B group, and the precursor, or mother substance, of vitamin A, and, of course, it will put colour into the yolks.

Work in the Home Garden

THE importance of continuity of supply in the production of vegetables can hardly be overstressed and because in most gardens a break in supply is most likely early in the season, when winter vegetables are exhausted and before the new season's supplies are ready, it is usually desirable that seed sowing or the setting out of young plants should be started in the new season as soon as possible. However, August sowings should not be extensive, because though conditions are usually sunnier in August than in June and July, soil temperatures are still comparatively low and frosts may be heavy; results consequently may be disappointing. In this article A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin, discusses work in the vegetable garden in August.

GROUND conditions, particularly where the soil is heavy or moderately heavy, are rarely consistently good throughout New Zealand in August and if there is a cold, wet spell after sowing, crops may fail.

The suitability of soil for sowing can be tested after it has been dug over. It is usually in the right moisture condition if it does not stick to the soles of the boots when it is walked on. If there is enough moisture, soil condition is less important for planting, but if the soil is inclined to be wet, it is better to work from a board laid on the ground than to walk on the surface when either sowing or planting.

Small sowings of most hardy vegetables can be made in well-drained soils in favourably situated gardens where the ground has warmed enough. Seed of beetroot, carrots, chinese cabbage, cauliflower, summer cabbage, kohl rabi, lettuce, leeks, turnips, radish, peas, salsify, scorzonera, spinach, silver beet, and parsley and many other herbs can be sown. Lettuces, silver beet and perpetual or spinach beet, early cabbages, cauliflowers, and onions can be set out in most districts and should mature quickly if strong, well-rooted seedlings are planted in well-manured soil.

In a few districts frost-tender plants such as tomatoes, cucumbers, marrows, pumpkins, and melons can be sown under glass to be ready for setting out when frost danger is past. Though the time taken to produce good plants for planting out varies according to the treatment given, tomatoes started in warm, favourable conditions usually take about 6 weeks and the other subjects mentioned about half that time to reach a suitable state for planting out.

Sowing should be governed by the facilities available and the extent of damaging frost. It is not advisable to have plants ready too early. The date of planting out varies from about mid-October to late October in some northern districts and to the second week in November in many southern districts.

Success in Home Gardening

Whether some gardeners have "green fingers" is debatable, but it is true with practically all gardeners that success follows the observance of a few simple but fundamental rules or practices which, though they seem to the beginner involved and difficult to learn, are quite logical and straightforward. Most of them can be discovered by common-sense consideration of the needs of plants in the different stages of their growth. The little knowledge needed of varieties can usually be obtained quite simply from a good descriptive seed list.

Claims of extraordinary merit for secret manurial mixtures or garden practices usually need not be taken very seriously. The gardener who practises good husbandry, the essentials of which are common knowledge among successful growers everywhere, will succeed with most of the crops he grows.

The successful gardener does not necessarily need to have had great experience, though experience helps when unforeseen problems arise. Even the best growers have failures

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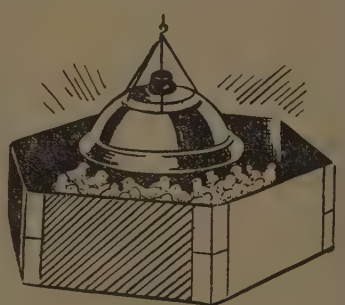

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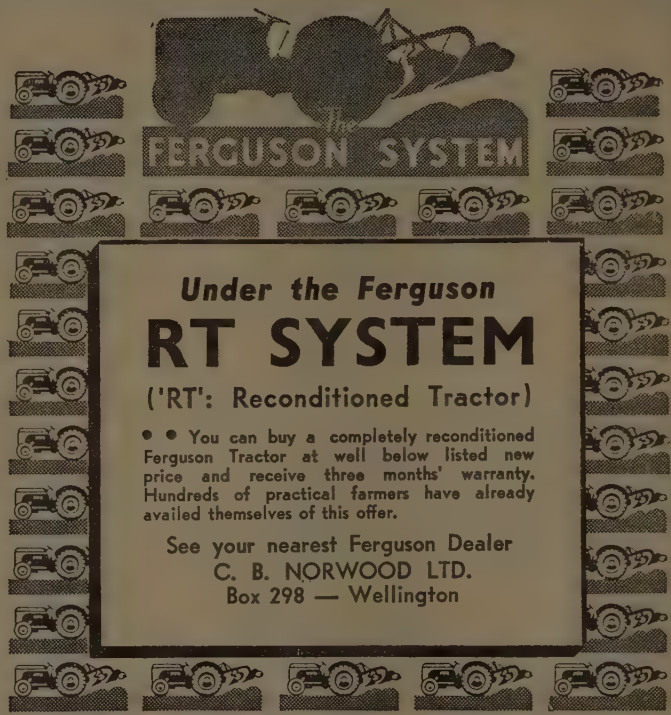

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which may be due to weather, poor seed, or other factors over which they have no control.

Asparagus

The consumption of asparagus is increasing in New Zealand and as the plant is easy to grow and the shoots are tasty and of good food value, it deserves to be grown more widely in gardens where there is space for it. However, the plant does not yield heavily in comparison with other vegetables.

An asparagus bed in suitable soil and properly established and cared for should last 20 years or more. In favourable situations where the soil is dry enough a new bed may be planted toward the end of July, but August is usually the preferred month for planting in the North Island; later planting may be advisable in most southern districts, where growth begins later and soil conditions may be unfavourable in July and August.

For home garden planting it is usual to buy plants from seedsmen or nurseries. One-year seedlings are usually chosen, as they transplant better and establish more readily than 2-year-old plants, which are considerably larger and therefore more subject to damage through transplanting.

If a new bed is to be planted, its situation should be deeply dug. For best results on most home garden soils the bed should be well manured with such material as well-rotted stack-bottom, stable or farmyard manure, or compost. Perennial weeds should be destroyed and if necessary, the area should be drained by breaking of the subsoil or where drainage is very poor by installation of field drains. Built-up or raised beds are an advantage where the surface soil is shallow or drainage is poor, though in some soils owing to expansion of the crowns and erosion of the soil crowns tend to be too near the surface after a few years and beds may have to be built up to keep the crowns covered.

In August or September the young plants may be set out in permanent positions. Male plants give a larger yield than female plants, but it is not practicable to sort the sexes and discard the female plants.

Asparagus is dioecious; that is, it has separate male and female plants. This fact is often overlooked when consideration is given to the choice of variety to plant or when plants are raised from seed. It means that breeding asparagus is more akin to breeding animals than most other plants, where both sexes occur in the same individual. There is no more chance of obtaining two identical asparagus plants from seed than of producing two identical animals (except identical twins).

Only by selection of the best plants of both sexes and seeding of them in isolation and continuation of this practice can improvement in the general standard of a so-called "variety" of asparagus be achieved and, what is equally important, maintained. Because of the labour and area required this work is beyond the means of the average home gardener. In the absence of such work, however, growing asparagus from seed is bound to result in the production of many poor plants.

Every effort should be made to secure plants whose "pedigree" is known.

Depth of planting is governed by soil type, but crowns are usually set about 8in. below soil level in loose, friable soil with the roots spread thinly in fertile soil in the bottom of a trench.

The top bud should not at first be covered by more than about 2in. of soil, as the young plants are liable to be retarded if deeply covered before they become established and are sufficiently strengthened. The crowns should be planted 18in. apart in single or double rows; single rows are generally preferred.

Beds, which should be not less than about 42in. wide, may be intercropped between the rows during the first 2 years after establishment; if small plants that do not interfere with the growth of the asparagus are grown, intercropping may be continued longer. Good growth of asparagus can be expected in well-drained, free-working loams. The popular belief that salt is essential is not borne out by commercial experience, though the plant is known to tolerate it.

Fertiliser Needs of Asparagus

Fertiliser needs vary according to the condition of the soil, but a fertiliser that has given good results over a wide range of conditions consists of 4 parts by weight of blood and bone, 1 part of sulphate of ammonia, 3 parts of superphosphate, and 1 part of sulphate of potash. It can be applied at from 2oz. to 4oz. to a square yard of bed, and if it is used on established beds, it is better applied in early spring or after the last cutting. Alternatively blood and bone at 3oz. to 6oz. to the square yard or farmyard or similar manure will usually encourage good growth.

Lime should be applied in moderation, though on most soils a little lime each year, say, about 1oz. to 2oz. to the square yard is likely to be beneficial in correcting acidity and assisting in the availability of plant food.

Weed control should be rigorous, and on large beds one of several proprietary brands of selective weed-killers which have given promising results on some commercial asparagus can be used.

The period during which asparagus can be cut varies greatly according to the bed and may range from about 6 to about 10 weeks. Harm is likely to be done to young beds by too early cutting. Only if the growing season is long and the plants are well established can a cutting of more than 2 weeks be made the third year from the time of sowing the seed (the second year after setting out); in the fourth year the cutting period should not exceed about half the season or about 4 weeks. Thereafter cutting can continue each year for about 6 to about 10 weeks according to season and growth and vigour of the bed.

The "varieties" or "strains" commonly grown in New Zealand include Mary Washington, Mary Washington No. 500, Paradise, and Connovers Colossal. A more recent introduction is K.B.F. A Christchurch grower is breeding plants from this strain, which is reputedly very vigorous.

[*Green and Hahn*

The foliage of Jerusalem artichokes gives good shelter in the garden, as it may grow 8ft. to 10ft. high.

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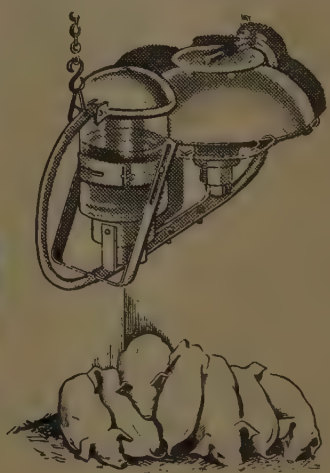

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Artichokes

The Jerusalem artichoke belongs to the same family as the sunflower, and its relationship to the sunflower seems apparent from even superficial comparison of leaves and habit of growth. Jerusalem artichokes are so hardy and easily grown that they deserve a trial in all home gardens where there is sufficient space and where their flavour and the variety they add to the menu are likely to be appreciated.

They need an open situation, but do not require special soil, though they yield better-quality tubers and heavier crops in good, moderately rich soil where there is adequate moisture. They are not usually troubled by pests or diseases and are easily propagated by planting the tubers, which may be either cut or planted whole. Small complete tubers are usually chosen; if the tubers are cut, each section should have one or more eyes.

Tubers are usually planted 3in. to 5in. deep (shallow in heavy soil and deeper in light soil) and 12in. to 18in. apart in rows 3ft. apart. To obtain full advantage of the sun rows should run north to south. In rich soil they may grow 8ft. to 10ft. high and though they afford good shelter, particularly where a double row is planted, care should be taken not to plant them where they will overshadow other crops.

As they are very hardy and keep well if left in the ground, they can be dug as required during autumn and winter, but should be lifted and stored in a cool place in August or they will recommence growth. They should be dug with a fork and every piece removed; pieces left are likely to interfere with the growth of succeeding crops.

Heavy yields can be expected where conditions are favourable, but in most districts digging should not be started until late in the season when the stems have nearly ceased growing, as the tubers form late.

The flavour of good varieties is sweet and rather watery and the nutritive value of the tubers is said to be about the same as that of the potato, though they require a different method of cooking. The tubers are somewhat like potato tubers, though the common varieties are much more knobby.

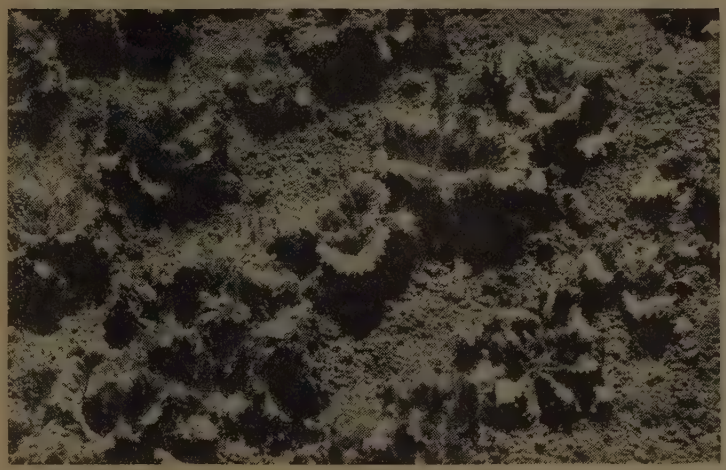
In New Zealand distinct varieties of Jerusalem artichoke are not usually listed by seedsmen; tubers are offered simply as Jerusalem artichoke.

Brussels Sprouts and Sprouting Broccoli

The popularity of brussels sprouts is well established, but sprouting (non-heading) broccoli equally deserves popularity. Like brussels sprouts, it is very hardy and stands well and if planted late, is among the latest of the winter greens. It has a delicious flavour and is worthy of more general use in New Zealand gardens.

To extend the period of availability of brussels sprouts and sprouting broccoli, a good plan is to make two sowings—one in August and another in October.

Good varieties of brussels sprouts include Scrymgeour's Giant, Fillbasket, Long Island Improved, and Cambridge numbers 1, 3, and 5. Varieties of sprouting broccoli include Calabrese Green Sprouting and Early Purple Sprouting.



[Green and Hahn

Soil for lettuce should be rich in organic matter and should be thoroughly cultivated.

Carrots

Seed of carrots can be sown as soon as soil conditions are favourable. In most home gardens several small successional sowings are preferable to one large one. Carrots are high yielding and grow well in deep, rich, well-drained, and well-cultivated soils that contain adequate well-rotted organic matter. Popular varieties include Red Cored Chantenay, Taranaki Strongtop, and Nantes.

Leeks

Leeks are one of the most reliable vegetables for autumn, winter, and spring. Though they last well in cool, moist conditions, they send up heads fairly quickly if subjected to dry, warm conditions. They are easy to grow and to ensure a long season of supply two or three sowings should be made. An early or mid-season and a late sowing will ensure a supply from autumn until late spring.

Leeks are rarely affected by insect pests or disease and though cabbage and cauliflower mature according to their season and are available or in best condition only then, leeks will stand for many months and may be used as required.

Seed may be sown from August to October in a box under glass or if the ground has warmed enough, in prepared ground outside. Seeds should be sown thinly and ½in. deep. When the young plants are about 8in. high, usually in December or January, they should be watered and carefully lifted and transplanted to their permanent positions.

Lettuces

Established crops of lettuce should be kept weed free and the soil prevented from becoming excessively compacted. Lettuce seed germinates at fairly low temperatures and the plants thrive in cool, moist, fertile, well-drained soils; if suitable varieties are chosen, the plants can be harvested throughout the year in most home gardens. Lettuce is a fair source of vitamins and because it is eaten raw, it loses little of its food value during preparation for the table.

The soil should be rich in organic matter and as the seed is small and germination relatively weak, cultivation should be thorough. Fairly heavy applications of organic manure are advisable on most soils, but very rapid growth as the result of too much nitrogenous manure may be conducive to tip burn (dying back of the leaf edges) in hot weather.

The soil must retain its moisture well, but drainage should be good and on areas that are inclined to be wet lettuce is best grown on a raised bed. Fertiliser recommendations vary greatly according to soil types and conditions. On soils where insufficient rich organic manure is available a fertiliser rich in nitrogen, phosphorus,

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and potash is recommended. As the plants should be kept growing steadily, side dressings of sulphate of ammonia or dried blood may be advisable.

Good varieties include Triumph, Imperial 615, and Imperial 44.

Onions

In most North Island districts and in some northern districts of the South Island main crop onions are grown from seedlings raised in autumn and planted out in early spring. In most central and southern South Island districts autumn sown plants are allowed to mature where they were sown and are harvested in November or December as "thick necks" without being encouraged to form large bulbs.

Ground where onion plants are to be set out should be highly fertile and well drained. On most well-cropped soils a complete fertiliser with organic matter such as rotted compost or animal manure should be satisfactory, as the onion is a gross feeder and the bed is unlikely to be over-fertilised. Better results will be obtained if the fertiliser is incorporated throughout the root area rather than in the immediate area of root development.

As the onion is sensitive to excessive soil acidity, lime may be necessary. An annual dressing of about 2oz. to 4oz. a square yard should give satisfactory results in most districts. It should be reduced in districts where rainfall is low.

Ground where onion plants are to be set out should preferably have been prepared some time in advance by thorough cultivation.

It is a common fallacy that onions always do best if grown on the same ground year after year. In most gardens they should be rotated as are other crops. Plants can be set out 3in. to 6in. apart in rows 12in. to 15in. apart.

Varieties include early maturing, giant, and long-keeping types, and in the garden where the flavour of onions is appreciated some of each kind should be grown. Plants are usually available from seedsmen in districts where it is usual to set them out at this time of year.

The variety most generally grown commercially is Certified Pukekohe Longkeeper, which is well suited to long keeping. Numerous other varieties are listed by seedsmen. Some of the names being synonyms, but where size is wanted varieties listed as Giant Rocca, Ailsa Craig, and Prizetaker Improved are worth a trial.

Peas

In many southern districts and in heavy, poorly drained soils or areas not lying favourably to the sun sowing of peas is best delayed for at least another month. Elsewhere sowing of a dwarf early variety can be made and can be followed where space permits with a successional sowing in 2 or 3 weeks.

A dwarf variety is usually preferable for the first sowing, but tall varieties may be used. They mature later. Alternatively two or three varieties with successional maturity dates can be sown at about the same time.

For early sowings seeds should be dressed with a suitable seed protectant, as diseases are especially troublesome early in the season, when the ground is cold and often wet. Some of the best varieties include Greenfeast, William Massey, Little Marvel, and Victory Freezer.

[*Sparrow*

Though it is too early in most districts to plant main crop potatoes, tubers can be set to sprout in a box in a light, airy, frost-free shed.

Potatoes

It is much too early yet in most districts to plant main crop potatoes, but tubers can be set to sprout in a box in a light, airy, frost-free shed or outbuilding. Well-sprouted tubers planted shallowly in well-drained soil in a favourable situation send shoots above the ground more quickly than unsprouted ones. Frost is likely in many districts until late October and in most southern districts until mid-November and shoots of tubers planted in August are likely to be destroyed unless continuously earthed up.

For early maturity an early variety should be chosen. Popular early varieties include Epicure and Arran Banner, but there are other good varieties well suited to specific locations. Where space permits a good plan is to try out several varieties.

Early potatoes can be set 10in. to 15in. apart in the bottom of trenches 4in. to 5in. deep and 24in. apart. If tubers planted very early are set deeply, they usually respond slowly because of the colder ground temperatures; if planted shallowly, they must be regularly earthed up to prevent frost damage.

Earthing up protects the tops from frost, but normal development is impossible unless the plant is enabled to develop green leaves, with which in the presence of light it manufactures sugar, which it builds up into starches and other substances. The advantage of early planting therefore lies mainly in the development of the underground system, which even if of only moderate size forms an excellent basis for development when frost danger is past.

Because of its freedom from disease Government Certified seed is recommended, but in districts where disease is not especially troublesome and good-sized Certified seed is difficult to get some home gardeners prefer to use medium or large tubers from a disease-free crop for early planting, because, other factors being equal, large tubers usually produce large plants earlier than small tubers.

If the tubers are to be cut, at least two eyes should be left on each section and planting should preferably be done immediately after cutting.

Rhubarb

August is a good month to establish a new rhubarb bed or to break up and replant an old one. Rhubarb is hardy, easy to grow, and yields heavily if well supplied with moisture and plant foods. The soil should be well drained and preferably well supplied with organic matter. The lighter soils that dry out are less suitable than the heavier, well-drained soils.

In New Zealand varieties can be grouped as early, main crop, and everbearing, though in good soils that do not dry out most varieties can be grown through the year. Rhubarb can

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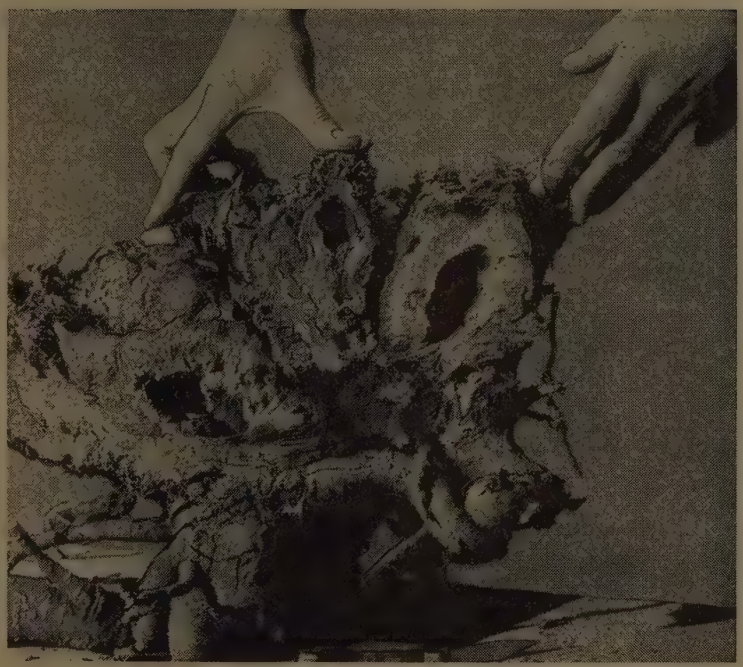
be raised from seed, which is usually sown in spring as soon as the soil has warmed enough, but to obtain varieties true to name plants for new plantations must be obtained from the breaking up of existing crowns.

Except in especially favoured situations rhubarb should preferably be lifted every 4 or 5 years, as the large roots or crowns tend to become hollow and weakened if undisturbed for longer periods. After lifting, the crowns should be separated with a sharp spade. For replanting, each single crown should have a piece of root attached and if it is set with the top of the crown about 1in. below the soil surface, a good plant should develop in a season.

In the home garden crowns should be set out 24in. to 30in. apart in rows 30in. to 36in. apart according to the vigour of the variety.

Unless plants are very vigorous, they should not be harvested until the second season after planting. In harvesting, the leaf stalk is grasped near the base and pulled with a twisting motion. Plants should not be denuded of their foliage entirely, nor should they be harvested for too long without an adequate rest period, during which a good growth of leaves is permitted to flourish to build up reserves for subsequent harvesting.

Established beds need little attention, but should be kept weed free and unless the soil is in very good condition, it should be dressed in the dormant season with organic material such as farmyard, stable, and poultry manure or compost. Alternatively blood and bone at 4oz. to 6oz. to the square yard gives good results on soils that are well supplied with moisture and of good tilth. In addition liquid manure or two or three applications of sulphate of ammonia or dried blood at the rate of 1oz. to the square yard may be advisable, but as the early dying down of the leaves and ripening of the crowns are usually important in the successful culture of early and main crop rhubarb in districts where the top growth dies down, it is not advisable to apply stimulating fertilisers later than that applied immediately after the last pulling.



[*Green and Hahn*

An old rhubarb crown, showing the hollows which develop in the thickened roots.

[*Green and Hahn*

Rhubarb can be forced quite simply by covering the crowns with a box.

A neutral to medium acid soil suits rhubarb and on most soils 2oz. to 4oz. of lime a square yard every 2 or 3 years gives satisfactory results.

Rhubarb can be forced by covering the crowns with boxes or straw. An early variety should be chosen. Forced rhubarb has less development of the leaf blade and the stalks are more tender and sweet.

There are many good varieties of rhubarb on the market and a selection may be made of early, main crop, and ever-bearing varieties. It is advisable to choose a variety the quality and vigour of which are known to be good, as varieties listed are not always true to name.

Care of Livestock during August

Contributed by the Animal Research Division

CARE OF THE CALVING COW

COWS about to calve should be brought into a handy paddock so that they can be kept under supervision. If a cow has difficulty in calving, veterinary assistance should be sought. This should be done as soon as it is obvious that the presentation is not normal and in any case within 6 hours of the beginning of labour. Unskilled interference exhausts the cow and makes the veterinarian's task more difficult or even impossible. Veterinary assistance should also be sought if the cows do not clean within 48 hours. Do not hang weights on the afterbirth.

FEEDING AFTER CALVING

Autumn-saved pasture is the best food for newly calved cows, but it must be grazed in small breaks which the cows will clean up in about 2 hours. They should continue to receive as much silage as they will eat and if the pasture is short and sappy, they should also receive hay.

CALF REARING

Calves should be fed their mother's milk for at least the first 2 days. This is important, as the first milk, known as colostrum or "beastings", contains substances which increase a calf's resistance to scours. Since over-feeding is an important cause of this trouble, feed not more than 6 pints daily during the first week, 7 pints during the second week, and 8 pints during the third week. If whole-milk is fed, there is no need to give more than 7 pints per day. If scours occurs, a supply of a sulpha drug should be obtained from a veterinarian immediately, as the drug is very effective when used promptly.

Calves should not be kept in a calf paddock. When 2 to 3 weeks of age they should be rotationally grazed ahead of the cows. This will ensure that they always have access to good, fresh pasture, which they will eat readily. Where good pasture is available calves can be weaned quite satisfactorily at 8 weeks.

Further information about the good rearing of dairy stock is contained in the Department of Agriculture's Bulletin No. 228.

SELECTION OF CALVES FOR REPLACEMENT

The full sisters of high-producing heifers should always be kept, as should the daughters of Merit Sires with a high progeny test. Provided they are sturdy, the calves of very old cows with good lifetime performance should always be kept, and there is no reason why the calves of well-bred heifers should not be kept. The twin of a bull calf should never be kept. Twin heifers may be kept with safety, provided they are not too small, especially if they are born early in the season.

MASTITIS

Milk from each quarter should be examined with a strip cup before milking. If it shows any abnormality or if the udder appears inflamed, treatment with penicillin should be started at once. Three tubes of 25,000 units should be injected at 24-hour intervals even if the milk appears normal after the first tube. Prompt treatment early in lactation will often save a quarter which otherwise might become weak or even blind.

STERILITY IN COWS

If difficulty was experienced in getting cows in calf last summer, now is the time to seek veterinary advice with a view to preventing similar trouble this year. Facilities for diagnosing infectious infertility are available at both the Wallaceville and Ruakura Animal Research Stations of the Department of Agriculture. Specimens must be submitted through Veterinarians or Livestock Instructors. Effective control depends on accurate diagnosis.

LICE ON CALVES

Calves and yearlings may become very lousy during late winter and early spring. Control can be effected by the use of suitable dips, sprays, or washes. Those containing DDT or BHC are most effective. Repeated treatments may be necessary, as the eggs are difficult to destroy.

CARE OF LAMBING EWES

About 10 per cent. of all lambs are either born dead or die during the first week. These losses can be reduced by careful shepherding. Many lambs and some ewes can be saved by skilled assistance during lambing. Always use a reliable lubricating antiseptic on hands and wrists. Faulty presentations must be corrected. A lamb should never be forcibly pulled away when a leg or the head is turned back.

A number of lambs die from suffocation through the cleanings remaining over their nostrils; these are very easily removed. Where necessary lambs should be assisted to get a drink. This is particularly important where ewes have very large teats. Drawing away a few squirts from these will reduce their size and enable the new-born lambs to suckle. Ewes with very large teats, very small teats, badly placed teats, or defective udders should be marked for culling. A big percentage of their lambs will die. Many lambs which die during cold or wet weather would survive if they got a good drink soon after birth.

WORMS IN HORSES

Red worms reduce the efficiency of farm horses. Drenching with phenothiazine now will prevent the pastures becoming contaminated with eggs and thus reduce the chances of reinfestation in spring. As phenothiazine causes very severe reactions in some horses, dosing should be done under veterinary supervision wherever possible. If this cannot be arranged, divide the dose recommended on the package into 5 parts and give them over 5 days.

DISEASES OF CHICKS

Navel disease of chicks is contracted in the incubator, which should be scrupulously cleaned and fumigated with formalin between batches of chicks. Pullorum disease can be controlled only by repeated blood testing of all stock, immediate disposal of all reactors, and thorough cleaning and disinfection of premises after each test.

RICKETS IN POULTRY

Vitamin D, known as the rickets-preventing or sunshine vitamin, is essential to young chicks for normal bone development. Chicks denied daily exposure to sunlight by intensive rearing or prolonged cloudy weather require vitamin D added to the diet, and it is advisable to use fish liver oils containing this vitamin as a routine supplement. The amount added varies according to the potency or strength of the oil; for example, up to ¾ pint of an oil containing 100 units of vitamin D per gramme to 100lb. of mash or half that quantity of an oil containing 200 units of vitamin D.

Spring Topdressing and Spring Cereals

Seasonal Notes by the Extension Division

EARLY autumn is generally the best time to apply both phosphate and potash to pastures. These fertilisers stimulate the clovers and the more vigorous clovers help to supply the grasses with nitrogen in winter and early spring. There are, however, many occasions when phosphate, potash, or both can be used very profitably in spring. On high-phosphate-fixing soils where heavy dressings are needed to keep the pastures producing at their best it is wise to apply half in autumn and half in spring. This can be done any time from August to October, paddocks being treated in turn as they are grazed. Paddocks which have been shut up for autumn-saved grass will also often benefit to a marked extent from an application of phosphate immediately after they have been grazed off, particularly if the clovers have been knocked back by the smother of long grass. In the same way many farmers get a marked response to an extra spring phosphate dressing on pastures cut for silage because the clovers have been given a setback and the phosphate stimulates their recovery. On soils where potash gives a response the addition of potash to these spring topdressings is well worth while. It is generally much cheaper to supply the grasses in the pasture with the nitrogen they require by maintaining vigorous clovers with the application of phosphate and potash in spring as well as in autumn than it is to topdress with nitrogenous manures. There are times, however, when application of nitrogen is well worth while, but this is seldom so in spring or early summer under normal conditions. If, however, growth is held up by unusually cold and wet weather, there is nothing like a dressing of nitrogen to bring growth away.

—C. J. HAMBLYN

* * *

NITROGEN FOR GRASS SEED

RECENT practice in the use of nitrogenous fertilisers for increasing the yield of grass seed crops can generally be justified from the immediate financial return. Whether it is desirable to topdress perennial, short-rotation, or Italian ryegrass crops will depend on the appearance of the sward at the time of shutting up. Thus a yellow, sickly, nitrogen-starved pasture should give remarkably payable results from a topdressing of 2cwt. of sulphate of ammonia or an ammonium nitrate-lime mixture. On the other hand the use of nitrogenous fertilisers on a healthy, vigorous sward of dominant ryegrass on very fertile land may cause clover suppression. Between these two extremes are the crops which would benefit from 1cwt. of nitrogenous fertiliser. Crops in their second and subsequent seasons are generally more in need of nitrogenous topdressing. Application should generally be at the time of shutting up.

Either type of nitrogenous fertiliser (sulphate of ammonia or an ammonium nitrate-lime mixture) is suitable on many soils, both giving equal responses. However, consideration must be given on sulphur-deficient soils, as in North Otago and elsewhere, to the superior merits of sulphate of ammonia in increasing grass growth through the nitrogen and also in improving the clover content of the sward through the response to sulphur. On most reasonably good cocksfoot stands topdressing in autumn and in spring at 2cwt. per acre each time of either sulphate of ammonia or an ammonium nitrate-lime mixture has proved payable, responses being evident not only in increased seed yield but also in improved germination and purity of seed. Experience has shown, however, that weedy, run-out stands of cocksfoot do not repay nitrogenous topdressing.

—P. R. BARRER

* * *

SPRING-SOWN CEREALS IN SOUTH ISLAND

IN Southland the majority of cereal crops are sown in spring; in Canterbury and Otago most of the wheat is sown in autumn and some of the oats and most of the barley in spring. Generally land intended for spring-sown cereals should be given thorough cultivation, and it should be finer on the top than is usually necessary for autumn sowing. If cereals follow swedes, it is not always necessary to plough. A satisfactory seed-bed may be obtained by thoroughly discing and working with a clodcrusher and harrows. The most popular variety of wheat for spring sowing is Cross 7. Another variety suitable for spring sowing is Hilgendorf and a bonus is paid by millers for this wheat, as it has a very high baking score. Wheat should be sown as soon as the land can be prepared in August. Sowing may be done into September or even early October. However, it should be done as soon as weather and soil conditions permit. The general seeding rate is 2 bushels per acre with 1cwt. of superphosphate, but in Southland 3 bushels per acre is usual with 2cwt. of superphosphate.

OATS

Oat growing has declined in popularity in New Zealand, so that it has become necessary to import both feed and milling oats from Australia. Excellent oats can, however, be grown, the most popular variety being Onward. Unfortunately, these oats are very prone to stem break. A more recently introduced variety is Milford, which is resistant to lodging. Other varieties available for spring sowing are Abundance, Royal Scot, Achilles, Spitfire, Forward, and Russet. The sowing rate for oats is 3 to 4 bushels per acre. The heavier seeding rate is usual in Southland. Discretion should be used in the quantity of fertiliser applied. If lodging is probable, it is advisable to sow without fertiliser, though this usually means later maturing and consequently later harvesting of the crop. Application of phosphate tends to hasten maturity. Oats should be sown early in spring, in September if possible, and generally not later than the end of October.

BARLEY

Barley growing is restricted almost entirely to Canterbury and Otago. Land intended for barley should be in good heart and well worked. Sowing should be undertaken in September and early October when conditions are right for steady, uninterrupted growth. Popular varieties for malting are Research and Kenia; Golden Archer, Chevallier, Spratt Archer, and Plumage Archer are grown to a limited extent. The sowing rate is usually 2 bushels per acre with superphosphate at 1cwt. to 2cwt. per acre according to the fertility of the paddock.

—W. FAITHFUL

Pasture Topdressing in North Island

By C. DURING,
Research Officer, Department of Agriculture, Wellington

IT is always difficult to say exactly what fertiliser and how much fertiliser and lime should be applied to a given field. This complexity arises because there are many factors to consider—economics, management, past topdressing history, and soil type. The influence of soil type in fertiliser requirements may be very distinct. In this the first of a series of articles fertiliser, lime, and trace element requirements of pastures are discussed in terms of important soil groups. These soil groups comprise related soils occurring under similar climatic and topographical conditions and follow the genetic classification adopted by the Soil Bureau, Department of Scientific and Industrial Research (1). In the next article of the series the mineral requirements of airborne volcanic ash soils will be discussed.

THE Soil Bureau distinguishes soils by their parent material and the development they have undergone since changing from parent rock to the present soil supporting pasture, scrub, or forest.

This article is limited to describing soils of the North Island formed on sedimentary rocks. These are rocks derived from material such as sand, silt, and fine clay deposited by rivers in ancient seas and later raised by earth movements to form the present outline of New Zealand. Limestone is also a sedimentary rock.

The soils derived from sedimentary rock and coastal sands vary greatly in natural mineral fertility. Even the poorest soils, however, can be brought to a high level of mineral fertility by the application of a few simple chemical compounds. These are phosphatic fertilisers, potassic fertilisers, ground limestone, and perhaps molybdenum and copper salts. On very limited areas zinc, magnesium sulphate, and boron may further raise fertility.

HEADING PHOTOGRAPH: Fairly steep hill soils formed from mudstone (yellow-brown earths, moderately weathered) in the Wairarapa. This is good store sheep country, particularly if it is topdressed with 1½cwt. to 2cwt. of superphosphate per acre every 2 to 3 years. Department of Scientific and Industrial Research photo.

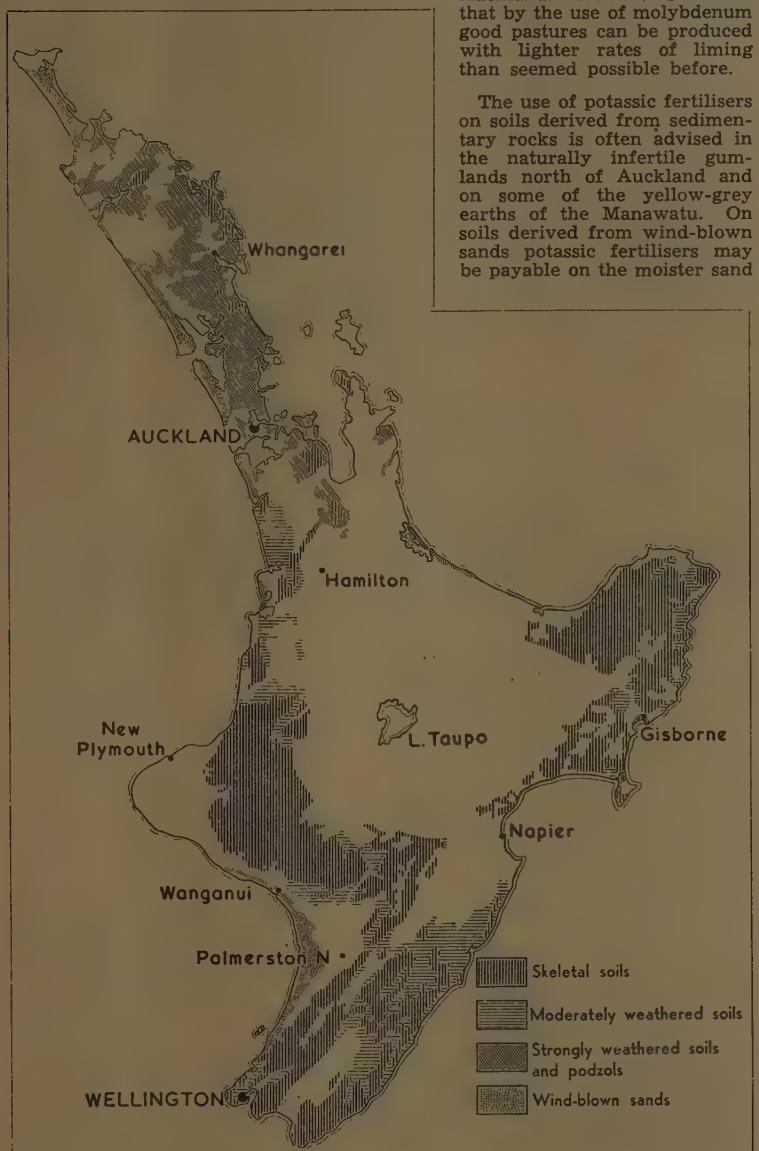
In the North Island nearly all soils derived from sedimentary rock need phosphatic fertilisers. The rate at which these should be applied depends less on the natural fertility of the soil than on the kind of pasture it will grow and its capacity to fix applied phosphate in a form unavailable to plants. Soils on which subterranean clover or *Lotus uliginosus* (*major*) would be the main legume in the pasture would need less phosphate than soils on which good white clover pastures are desired. Soils receiving a high average rainfall usually need more phosphate to keep pasture from reverting to scrub and weeds than soils in the dry districts of, for instance, central Hawke's Bay.

Little is known about the extent to which phosphate is fixed in an unavailable form on soils derived from sedimentary rocks. Only a few years ago failure of water soluble phosphates to stimulate pastures was attributed to phosphate fixation; today there is some evidence that this may be due to trace element deficiencies.

notably of molybdenum. Long-term trials to obtain an estimate of phosphate fixation have not been done except on a few experimental stations.

Liming improves the fertility of most soils derived from sedimentary rock. Some soils derived from limestone and calcareous mudstones and sandstones in the drier east coast districts of the Wairarapa and Hawke's Bay are an exception. Particularly, the steep hills formed from these parent materials need no lime. The rate at which lime should be applied to be effective depends largely on soil type. Quite small amounts of lime, from 2cwt. to 6cwt. per acre, markedly improve pasture production on some soils in the southern half of the North Island. The more clayey soils of the warm and moist northern districts, however, show a need for heavy liming. In the past 2 tons per acre and over was advised on many clay soils and gumland soils near and north of Auckland. Now it is known that by the use of molybdenum good pastures can be produced with lighter rates of liming than seemed possible before.

The use of potassic fertilisers on soils derived from sedimentary rocks is often advised in the naturally infertile gumlands north of Auckland and on some of the yellow-grey earths of the Manawatu. On soils derived from wind-blown sands potassic fertilisers may be payable on the moister sand flats along the Manawatu coast. Potash deficiencies are also expected to occur in all districts where the rainfall exceeds 60in. to 70in. per annum, particularly on fields frequently cut for hay.



[Adapted from a map of Soil Bureau, Department of Scientific and Industrial Research

Pasture responses to small amounts of copper sulphate have been observed only in the last 2 years. Several soil types are involved, namely peats, young coastal sands, very poor pipe clay gumland, sandy gumlands, and some hill soils derived from sandstone.

Molybdenum deficiencies are found in many soils. The most spectacular pasture responses to this element have occurred on clay hills derived from sandstones in the Warkworth district, north of Auckland.

Zinc, magnesium, and boron deficiencies so far seem to be of very minor and only local significance in pasture production.

SOIL GROUPS

Yellow-grey Earths

Concurrent with overseas practice the names adopted for the main soil groups often describe the dominant colour of their profile. It is a nomenclature somewhat confusing but difficult to change. The yellow-grey earths are associated with an annual average rainfall of about 20in. to 35in. They occur therefore only in the driest districts of the North Island, in central Hawke's Bay (see map on page 43). Most soils from this group are formed from limestone, mudstone, and sandstone, but a small proportion of pumice may be present. The quite large areas of flat land in central Hawke's Bay are mainly derived from old alluvium deposited by rivers from material carried down from the hills. The parent material of the old alluvia is therefore similar to that of the hills. The soils formed on the old alluvia, however, often differ quite markedly from hill soils. Being flat or nearly so, they are more receptive to rainfall; there is less run off, hence more leaching; and there is more moisture for chemical and biological activity, hence more advanced soil development. Often there is a well-developed clay pan in the subsoil which is practically absent in hill country. This clay pan formation is typical of yellow-grey earths in both Islands. It makes for pugging in winter and fairly quick drying in summer. Mole drains usually last well on these soils.

Owing to the relatively low rainfall the yellow-grey earths are not strongly leached. The word leaching

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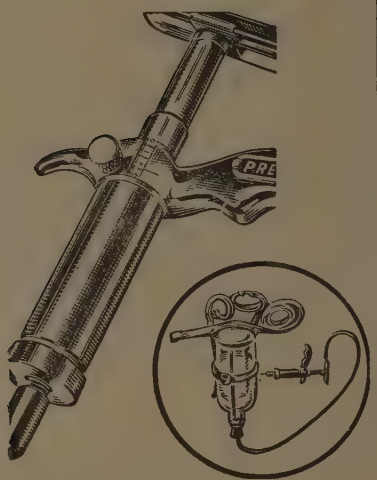

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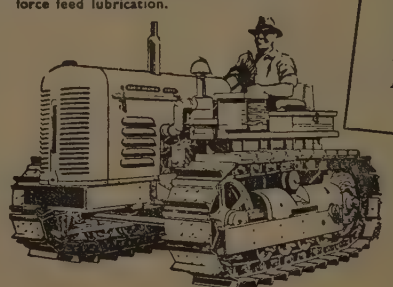

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[*Department of Scientific and Industrial Research*

A typical landscape south-west of Napier. The soils are fairly fertile yellow-grey earths with compact subsoils. They have received very little topdressing and ingress of secondary growth is just beginning. A conservative dressing would be 2cwt. of superphosphate per acre every 3 years on the hills and every 2 years on the flat. This type of country can be farmed efficiently without lime.

describes the process by which minerals in the soil are carried down by percolating water as soluble salts from the top layers to deeper layers, often outside the reach of feeding roots. Naturally the higher the average rainfall is the more water tends to percolate through the soil and the more severe the leaching, or the removal of minerals from the topsoil, tends to be. Many of these minerals are essential to plant growth, and hence a strongly leached soil is usually a soil with low natural fertility. However, though high and well-distributed rainfall in time tends to produce poor soils, it also is essential to high pasture production. For this reason many of New Zealand's naturally poor soils have a very high potential productivity, provided the right plant nutrients are added, and the better soils of the drier climates, which were the ones to be farmed first, do not always offer the same scope for improvement.

The yellow-grey earths of central Hawke's Bay are a relatively fertile group of soils; they seem to contain very few areas of molybdenum or other trace element deficiencies and they need little or no lime to grow good pastures.

Pasture Responses

Generally pasture responses in these soils to lime, fertilisers, and trace elements can be summarised as follows:—

Responses to lime are very slight to slight.

Responses to superphosphate and serpentine superphosphate are good.

Lime reverted superphosphate seems less efficient.

Ground Nauru rock and North African rock phosphates have given poor responses in the very few trials in which they were included.

Slight responses to potash are not uncommon in pasture trials.

Molybdenum has not been tried very thoroughly in central Hawke's Bay; a good response has occurred on one soil type only, Waipukurau sandy loam.

[*From map of Soil Bureau, Department of Scientific and Industrial Research*

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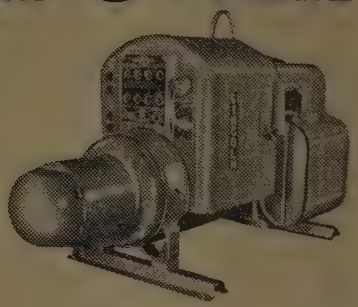

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Hill country east of Stratford with skeletal soils of yellow-brown earths. A mild climate, high rainfall, and a quick drop in fertility after the virgin forest was removed have favoured reversion to scrub and bush. On the very steep slopes soils are derived from the underlying sandstone and mudstone. The easier slopes are covered with andesitic ash. Liming is not necessary, but the easier slopes can be held in production only by fairly regular dressings of phosphatic fertilisers. Potash responses are likely after some years of intensive farming.

Cobalt deficiencies in stock are not known to occur.

As the effect of lime dressings on pasture growth is generally slight, the first call is for superphosphate. The use of potash is not advised except possibly on the more deficient areas such as hay fields.

Rate of Application of Superphosphate

In central Hawke's Bay the rate of application of phosphates is closely linked to the potential productivity of the pastures and the intensity with which a farmer wishes to utilise his property. For instance, the soils which hold white clover-ryegrass pastures well through the frequent dry summers may well receive annual dressings of 2cwt. of superphosphate per acre. The lighter, shallow soils of the hills and many of the stony flats which revert to subterranean clover pastures can do with lighter annual dressings, 1½cwt. to 1½cwt. per acre.

In central Hawke's Bay topdressing widens the gap between pasture production in winter and spring and production in summer. Winter and spring production is stimulated, but summer production, particularly in a drought year, may remain low. Regular topdressing, therefore, tends to force farmers to meet the widening gap in seasonal food supplies by changing from breeding sheep to fattening sheep, or by growing more lucerne, making hay or silage, and providing more supplementary crops for summer.

Yellow-grey Earths Transitional to Yellow-brown Earths

The transitional yellow-grey earths occupy a large area in the Manawatu district, occurring in one block from Wanganui to the Manawatu Gorge and continuing south in a narrow strip along the Tararua Range from the Manawatu Gorge to Shannon (see map on page 43). Towns such as Marton, Halcombe, Bulls, Sanson, Feilding, and part of Palmerston North lie on these soils. Marton loam is a typical soil type of this group. Smaller areas of the transitional yellow-grey earths occur in the Wairarapa and in Hawke's Bay.

The transitional yellow-grey earths are associated with a higher rainfall (30in. to 40in. per year) than are the proper yellow-grey earths, and for this reason they are slightly more leached. Leaching, however, has been offset to some extent by the heavy native bush which grew on some of these soils. This statement needs to be explained. All plants absorb nutrients from the soil, carry them to the leaves and stems, and finally return them to the soil surface, for instance, by way of the fallen leaves. Whether the soil beneath a plant remains fertile depends largely on the rate at which the plant absorbs nutrients and returns them to the surface. Plants with a fast rate of growth and a high demand for plant nutrients such as calcium, phosphorus, and potassium usually offset the detrimental effects of leaching quite considerably.

Other plants with a low rate of growth and low plant nutrient demands do little to diminish the severity of leaching and leave an infertile soil.

A hard clay pan 18in. to 24in. below the surface is commonly found in this soil group and is particularly evident at the beginning of a downward slope. The occurrence of heavy, brown iron concretions in the clay pan has caused many to call them "ironstone" soils, a name which should be reserved for the volcanic "ironstone" soils found north of Auckland, mainly in Bay of Islands County. The Department of Agriculture and Massey Agricultural College have carried out numerous experiments on the transitional yellow-grey earths and their requirements for vigorous pasture growth are therefore well known.

Pasture Responses

This knowledge of pasture responses to lime, fertilisers, and trace elements can be summarised as follows:—

Lime gives good responses up to pH 6.0 to 6.2 but seems of no benefit above pH 6.0 to 6.2. Many unlimed

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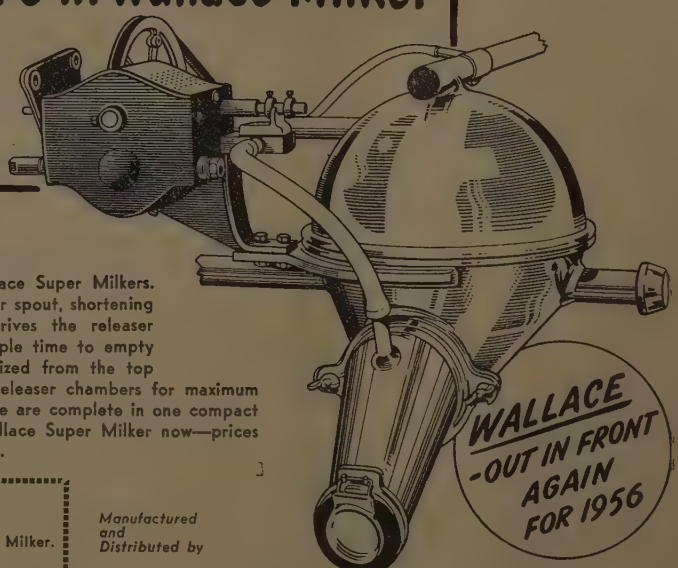

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soils have a soil reaction of pH 5.4 to 5.7; they respond quite well to small dressings of lime, say 3cwt. to 5cwt. per acre, but an initial dressing of 1 ton per acre is far more effective; maintenance dressings of 10cwt. per acre every 3 years are advocated.

Of the phosphatic fertilisers, superphosphate, serpentine superphosphate, basic slag, double superphosphate, and the fusion products of rock phosphate with magnesium silicate rock are all equally good if applied at equivalent rates of phosphorus. North African phosphate has proved good on unlimed ground.

The rate at which these phosphates have to be used to maintain vigorous pastures under good management is believed to be equivalent to that of 2cwt. to 3cwt. of superphosphate per acre each year.

Superphosphate applied at the low rate of 1cwt. per acre each year led to pasture deterioration at Massey Agricultural College under heavy stocking and rotational grazing. At the Marton Experimental Area, on the other hand, on a related soil type, 2cwt. per acre applied 16 times over a period of 9 years has resulted in a considerable build-up of residual available phosphate which could maintain pasture production for another 4 years without further topdressing.

Pasture responses to potash are usually slight, but are sometimes good, particularly on hay paddocks. The quick test for potash on the yellow-grey earths may at times indicate a smaller amount of available potash than is really present. Molybdenum has been tried in a large number of trials. Results from these so far have not established a need for using this element. Though several

A soil profile fairly typical of greywacke hills (skeletal soils, → yellow-brown earths). Stones come right to the soil surface. The weathered part of the soil is shallow and coarse, illustrating the combined effect of steady surface erosion and low moisture supply due to excessive run-off.

Steep hills of the southern Tararua Range (skeletal soils, yellow-brown earths). Greywacke is the parent material. On less steep hills formed from the same parent material 3 years of phosphatic topdressing combined with oversowing of white clover and use of molybdenum can tremendously increase carrying capacity and prevent infestation of tauhinu, gorse, and hard fern.

Both photographs by Department of Scientific and Industrial Research.

[*Department of Scientific and Industrial Research*

Podzol surrounded by strongly weathered yellow-brown earths. The photograph well illustrates the effect of the kauri on soil formation. The light-grey area with the peaty humus layer on top marks the former site of a kauri tree. Only small amounts of plant nutrients are present in this area.

distinct responses have been observed, they were fleeting. For this reason liming to pH 6.5 and the use of phosphate are still the standard recommendation for pastures, with potash to be used only after a trial strip has proved its value.

Yellow-brown Earths

The yellow-brown earths occur in districts receiving an average annual rainfall of over 40in. The parent material on which they have developed is similar to that on which the yellow-grey earths were formed, namely sedimentary marine deposits of sandstones, siltstones, and mudstones raised by successive earth movements above sea level and shaped by them and subsequent erosion into hills and mountains. The higher rainfall has speeded the processes of weathering and leaching. One of the most striking effects of more intensive weathering is the darker colour of subsoils, a result of the more complete oxidation of iron-containing minerals. The rate of weathering usually increases with higher average temperatures, so that the yellow-brown earths north of a line roughly coinciding with the historic distribution of the kauri are mainly clays and clay loams, and south of this line this group of soils contains progressively less clay (2) and consists of silt loams and sandy loams.

The leaching effect of rainfall on the yellow-brown earths cannot be described simply. The rate of leaching is affected by the type of vegetation, by the amount of rainfall, and by the rate of surface erosion. For instance, where vigorous broadleaf forest was sustained, the loss of plant nutrient from the topsoil may be small, but where kauri (as in the north) or other podocarp species was the dominant vegetation the soil is quickly depleted of its fertility and its soil structure severely damaged, particularly as the acid litter of decaying leaves typical of many podocarp species assists the leaching effect of rain-water and hence accelerates soil deterioration. Slope, however, is another factor which has strongly influenced the development of the yellow-brown earths. On the sloping hill faces, even on slopes of only moderate steepness, much of the rain, instead of penetrating into and percolating through the soil, runs off the surface, removing small quantities of topsoil. This gradual erosion, combined with reduced percolation, keeps hill soils relatively young and more fertile than related soils of the plains or of slight slopes. This influence of slope on soil development is particularly evident north of Auckland.

With progressive leaching yellow-brown earths in time become podzols. Podzol is a Russian word meaning similar to ash and refers to the light ash-grey or bleached appearance of this type of soil. True podzol profiles can be seen in Northland on the so-called pipe clay gumlands, where the continuous action of rain-water moving through the acid litter of the kauri forests has reduced plant nutrients to a very low level indeed in the topsoil and subsoil. In the podzols some minerals such as iron and aluminium salts may become concentrated in the subsoil with fine clay and some humus and form a slow-draining, hard pan. This is seen on the sandy gumlands north of Auckland.

The range of yellow-brown earths from young and shallow soils to podzols is grouped as follows for the purpose of this article:—

1. Skeletal soils with shallow topsoils occurring on steep slopes.
2. Moderately weathered soils, including soils of many stages of leaching.
3. Strongly weathered soils, also including soils of many stages of leaching.
4. Mature podzols.

1. The Skeletal Soils

The skeletal yellow-brown earths with few exceptions represent the millions of acres of steep hill country soils of the North Island and the Marlborough Sounds which are not derived from overlying volcanic ash or from other related volcanic material.

The map on page 41 shows that they are most extensive in the Wellington and Hawke's Bay Land Districts and south of Auckland. North of Auckland and on the Coromandel Peninsula much of the hill country is not derived from sedimentary rocks but from volcanic andesites and rhyolites.

Until a few years ago the outlook for the steep New Zealand hill country was not bright. Deterioration was apparent everywhere, production had declined to a level where upkeep of fences was not economic, and wool prices had not kept up with rising costs. Many hill farms were not

Pipe clay gumland (a mature podzol) near Whangarei in reasonable dairy pasture after treatment with lime and phosphate. On these soils potash, copper, and perhaps other elements will play a major role in pasture production.

economic units even where they included a fair proportion of ploughable land. In the last few years, however, this has changed somewhat. Good wool prices and the advent of new techniques of topdressing and track making have already done much for hill country improvement. Increased use of superphosphate, combined with clover oversowing, is probably responsible for most of this improvement. Without the introduction of clover—white clover, subterranean clover, and perhaps *Lotus uliginosus* (*major*) (with or instead of the clovers)—little response to topdressing can be expected. Without topdressing oversown clovers seldom establish satisfactorily. *Lotus uliginosus* (*major*) in the wetter districts may be an exception.

Clover seed inoculation may be an important factor in the establishment of white clover, subterranean clover, and red clover on country which is devoid of these clovers. Clover seed inoculation is already widely practised in Australia and will no doubt become more popular here.

Pasture Responses

In topdressing, hill country farmers want to know what kind of phosphatic fertiliser they should apply, whether liming is absolutely necessary to get pasture responses, and whether molybdenum should be used.

Molybdenum is deficient in many soils derived from sandstone. However, some of these sandstones, such as greywacke, are not easily recognised as such by farmers. For this reason the local instructor should be consulted. The importance of soil type in connection with topdressing has never before been as evident as with molybdenum, and it is therefore very necessary that an expert opinion be sought before large quantities of molybdenum superphosphate are applied. For instance, on one sandy soil in the Wairarapa, probably Ngaumu fine sandy loam, sodium molybdate at 2½oz. per acre has clearly depressed pasture growth. In greywacke hills in one or two cases in the southern Manawatu the addition of small quantities of lime to molybdenum and phosphate plots has improved growth. In the Wellington district, however, on a similar soil, Makara silt loam, lime has contributed nothing to the effectiveness of molybdenum.

North of Napier a thin coat of pumice ash often overlies the sedimentary rock. This pumice is easily mistaken for sandstone. Pastures on these soils are not known to respond to molybdenum; on the contrary the molybdenum level of the herbage may be already very high and the addition of even small amounts of molybdenum may make the pasture dangerous to stock (3).

Extremely molybdenum-deficient soils have the following features in common: Very slight or disappointing responses to superphosphate alone; excellent responses to very heavy application of lime; good responses to basic slag.

If soils are known to respond well to superphosphate or serpentine superphosphate without lime, or with small dressings of lime, only a moderate degree of molybdenum deficiency is likely.

The merit of various types of phosphatic fertilisers can be summed up as follows:—

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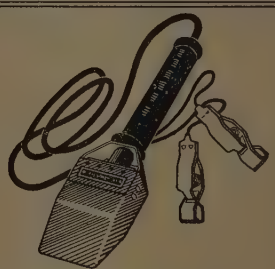

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popular on most soils derived from greywacke between Wellington and Palmerston North and in the Wairarapa along the Tararua Range.

Basic slag, apart from its quite considerable effect in reducing soil acidity if used over a number of years, contains small amounts of molybdenum and possibly other trace elements such as vanadium which may be of value on a limited number of soils. As it is difficult to apply from the air, a few trials comparing basic slag with superphosphate plus light rates of lime and molybdenum superphosphate have been laid down on hill and undulating soils, on which basic slag has the reputation of being a better fertiliser than superphosphate. In these few trials superphosphate combined with molybdenum and sometimes with very light rates of lime promises to be as effective or more effective than basic slag. Molybdenum superphosphate (and sometimes 2cwt. to 3cwt. of lime per acre) is now recommended on soils on which basic slag has been best but where it cannot be applied conveniently. Apart from the districts mentioned above, molybdenum superphosphate is already being used extensively on large areas of steep hill country in Raglan and Rodney Counties and in other districts north and south of Auckland where skeletal soils derived from greywacke and certain sandstones occur.

Superphosphate and serpentine superphosphate: Weight for weight comparisons of these two fertilisers on steep hill country, if anything, have favoured superphosphate, probably because it has a higher phosphorus content. For ease of storage and general handling, however, serpentine superphosphate is often preferred to straight superphosphate.

Double superphosphate: Double superphosphate has been tried in the steep hill country east of Taranaki, where it has been as good as superphosphate. It has not been tested critically in those areas such as the east coast of the Wairarapa where high freight costs favour its use compared with ordinary superphosphate. Its regular use cannot yet be recommended on steep, dry hill country until the sulphur requirements of such country are known.

Lime: Steep hills, particularly in the southern half of the North Island, are usually not very acid in soil reaction; pH values of 5.4 to 6.0 are common. The calcium status is not particularly low except on some very poor sandy soils. Heavy applications of lime should therefore not be necessary to get good results from phosphate or phosphate and molybdenum. Trials with lime at rates from 2cwt. to 6cwt. per acre have been carried out on several hill soils, for instance, on Makara silt loam. Generally these light rates have given pasture responses, though sometimes they seem to depress growth slightly if the lime was applied with 2½oz. of sodium molybdate per acre. Only trials can tell when it is advisable to use light dressings of lime, when it is sufficient to use just phosphates, when to use phosphates and molybdenum, and when to use all three.

Rate of Application of Phosphate

One single aerial topdressing with superphosphate or molybdenum superphosphate often causes a visible improvement in pasture. Everything looks greener from afar and close inspection may reveal that the annual clovers have been stimulated and more white clover than before is present. Nevertheless, the effect on carrying capacity from one dressing is usually small. For appreciable increases in production clovers need to be fairly vigorous for more than 1

▼ Pipe clay gumland (podzol) near Whangarei, showing the light but variable colour of the cultivated soil.

year. Perhaps they must produce surplus nitrogen in a quantity which will allow the associated grasses to make use of the applied phosphate. That this is so has been proved in subterranean clover pastures in Australia. Usually, annual topdressings for several years are needed for this. With more vigorous, dense pastures the danger of weed invasion also recedes, provided pasture improvement is accompanied by good pasture management.

Pastures on soils receiving a high average annual rainfall, such as in the back country of Taranaki, have been shown to respond particularly well to heavy dressings of phosphate. They respond better to heavier rates than do drier soils, and it is thought that they need heavier and more regular applications to reduce the threat of reversion and weed invasion.

If a single topdressing, repeated perhaps only every few years, does little to increase carrying capacity and if several consecutive dressings are needed to give worthwhile improvement in this respect, it is obvious that initial topdressing should be concentrated on one section of the farm rather than be spread thinly over the whole farm. When topdressing has proved that one section can carry much more stock than before, it is time to begin on another block and reduce topdressing on the first block to maintenance. Maintenance probably would be seldom more than 2cwt. of superphosphate per acre every second year except perhaps in the high-rainfall areas receiving 60in. and over of rain a year.

2. Moderately Weathered Yellow-brown Earths

The map on page 41 shows the distribution of the moderately weathered yellow-brown earths. They are nearly all hilly and undulating soils which can be cultivated by giant disc or plough. They differ from the steep skeletal soils not because of their parent material but because of their easier slope, deeper profile, better water-holding capacity, and thus their higher production potential. Only a few of these soils have drainage problems. Their fertility depends mainly on parent material. Those derived from poor parent material such as sandstone or argillite and the more infertile type of shale and mudstone could in the virgin state only grow a low-fertility-demanding vegetation which in turn returned little to the soil, thereby doing little to counteract leaching.

The naturally fertile soils on which pastures have least deteriorated are mainly derived from limestone, lime-rich sandstones, and lime-rich mudstones. The good mudstone soils are usually subject to much slipping, but slips heal readily.

Pasture Responses

Lime: Liming is usually desirable on silt loams and sandy loams with pH 5.7 and under, and on the heavier soils with pH 5.4 and under. The only safe guide to liming, however, is given by trial and experience.

The rate of liming which can be carried out economically is often dictated by slope and accessibility. Experiments with light rates of lime have not been put down on these hill soils except in the Wellington and Palmerston North districts, where 3cwt. of lime per acre applied with superphosphate has resulted in marked improvement of pastures compared with results from treatment with superphosphate alone. All the soils on which light rates of lime have given good responses are thought to be slightly molybdenum deficient.

Molybdenum: In southern Hawke's Bay and the Wairarapa many new trials with molybdenum have been put down very recently and results are not yet known. In the Taihape, Hunterville, Taumarunui, and Wanganui districts molybdenum-responsive soils derived from sedimentary rock, if they occur at all, will be small in extent. None has been found so far. Molybdenum-responsive soils in this group are mainly confined to the Wellington, Wairarapa, and Manawatu districts.

Molybdenum superphosphate or serpentine superphosphate seems the most convenient form in which to apply molybdenum. As in the current commercial product 1 ton of fertiliser contains the equivalent of 1lb. of sodium molybdate, it is estimated that 3cwt. of molybdenum superphosphate per acre supplies enough molybdenum for at least 3 to 4 years on most soil types. Very likely the effect of one such application of molybdenum will last much longer than 3 years on many soil types in this group.

Rate of Application of Phosphate

When deteriorated pastures on poor hill soils are being converted into better pastures by cultivation or simply by oversowing of clovers and topdressing experience seems to indicate that for the first 3 years regular topdressing with superphosphate at 3cwt. per acre is necessary. The maintenance dressing on most soils is frequently 3cwt. of superphosphate every second year.

Several successive topdressings and clover oversowings can change brown-top-danthonia pastures carrying ¾ sheep per acre to white clover-subterranean clover-browntop-dogstail-ryegrass pastures carrying 2 to 3 ewes per acre.

3. Strongly Weathered Yellow-brown Earths (4)

The warmer and more humid the climate is the more intense is the chemical weathering. Partly for this reason greywacke north of Auckland has given rise to a different soil from that formed on greywacke on the Marlborough Sounds area. This also applies to soils formed on other parent materials which occur both north of Auckland and south of the Waikato. The north of Auckland soils of this group contain more clay and less sand. They are therefore much heavier soils, more difficult to cultivate, stickier when wet, and much harder and prone to crack when dry. Most of the strongly weathered yellow-brown earths of the north are on undulating to hilly country, popularly known as clay hills.

Pasture Responses

Fertiliser requirements of pastures on these soils can be discussed only if this group is split up further into steep hill soils, moderately hilly soils, and nearly flat and undulating soils. In general the easier the topography is the more rain is absorbed and the less erosion takes place. On the steeper soils much of the rain runs off and takes some of the topsoil with it. The result is that the steeper soils are younger soils, less leached by percolating rain-water, and less strongly weathered than the less steep soils. For this reason the steep hill soils are often quite fertile and have persisted in permanent pasture for many years without topdressing. The Auckland climate, however, favours the ingress of secondary growth. Pastures on the less steep hills and the lightly undulating clay soils have often been replaced by manuka and other weeds. As it was usual to burn the manuka scrub periodically, the organic matter in the topsoil has been largely destroyed, leaving a soil very hard to cultivate and very poor in plant nutrients.

Molybdenum promises to be of much more importance on the strongly weathered clay soils of Auckland than on the moderately weathered silt loams farther south. In the south pasture responses to molybdenum have been slight and have been confined mainly to the greywacke hills of Wellington and the Tararua foothills. In the north excellent responses are obtained on large areas, for instance, on soils derived from fertile sandstone formations, typified by the picturesque coastal hills of Warkworth (Puhoi clay loams and Whangaripo clay loam). Good responses are also obtained on the far less fertile soils derived from greywacke, forming nearly all of the coastal hills between Whangarei and the Bay of Islands (Marua clay loam and Rangiora clay). Other molybdenum-responsive soils derived from sedimentary rock are found scattered right through the North Auckland Peninsula. In fact, there are not many clay hill and undulating soils between Auckland and Wellsford on which pastures do not respond to molybdenum unless they have been heavily limed in the past or already topdressed with molybdenum or repeated applications of basic slag.

The use of molybdenum should save lime in the northern half of the North

Red Hill sandy loam at Rehutai, Northland. In the background are the sea and unconsolidated sand. The Red Hill soils contain much pumice carried down from the centre of the North Island by the Waikato River, and deposited or blown on to the coast long distances away. Potash is not yet needed on these soils. Where superphosphate is applied lime and in some places molybdenum may give further pasture improvement.

Island. Limited evidence from top-dressing trials indicates that in the presence of molybdenum the liming of clay soils to only pH 5.6 to 5.8 is sufficient for maximum production. In the absence of molybdenum a soil reaction of pH 6.2 to 6.5 seems desirable. As 1½ to 2 tons of lime may be needed to change the soil reaction from the pH level required in the presence of a few ounces of applied molybdenum to that required in the absence of molybdenum, the saving to the farmer is considerable. If soils have already been limed to pH 6.2 to 6.5, topdressing with molybdenum is not expected to affect pasture growth. Pasture responses to molybdenum, however, have occasionally been observed at pH levels (5.9 to 6.2) slightly below this.

On the steep hills to which heavy dressings of lime cannot be applied molybdenum superphosphate or molybdenum serpentine superphosphate applied every 3 to 4 years may at least partially replace the hitherto popular basic slag.

Potash deficiencies are unfortunately becoming fairly common on the more leached clay soils of easier contour, particularly on soils derived from some of the sandstone formations, for instance Warkworth clay. These are the same soils on which pastures respond so excellently to molybdenum. Though farmers therefore may hope that they will save a little money on lime, they will perhaps have to spend a good deal more on potassic fertilisers in the future. How much potash is required on different soil types to maintain good pastures is a question which is now being studied by co-operative trials.

One of the soil types on which potash may become a problem is the Waikare clay, the dominant soil type on the so-called gumlands just north of Auckland. It is a soil which could be brought into good pasture with very heavy dressings of lime (up to 4 tons per acre in the initial stage of development) and phosphate. Today it is known that with the use of molybdenum the initial dressings of lime can be reduced to about 2 tons per acre. Potash deficiency, however, is becoming more common, particularly on fields frequently cut for hay, and there is some evidence that once the potash reserves of this soil have been exhausted rather large quantities of potash may be needed to restore them.

4. Mature Podzols

Mature podzol soils are popularly known as the pipe clay gumlands and pipe clay gumland flats. A good example is the Wharekohe silt loam. As already indicated water passing through the acid litter shed by the kauri tree has great powers of speeding up soil deterioration, particularly in the Auckland climate in districts where the annual average rainfall exceeds 50in. The north of Auckland podzols are unique in that they may have up to several feet of almost pure silica silt and sand containing most plant nutrients in only very small amounts (5). However, the depth of this impoverished and very acid layer of silica varies considerably from place

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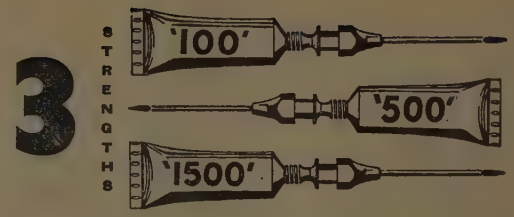

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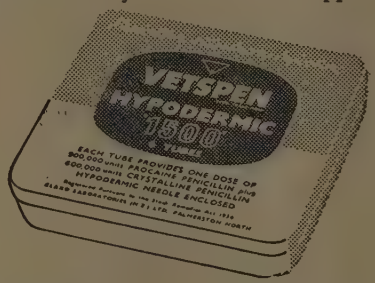

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to place, according to slope and the trees which have formerly grown there.

The topsoil of these podzols is pale grey to white and the vegetation consists mostly of stunted manuka. Drainage is often poor.

In spite of the unattractive appearance and original poverty of these soils, they can be made to support quite good dairy pasture. Perhaps as knowledge of their trace element requirements increases some of the better-drained soils may be induced to grow excellent dairy pasture.

The great advantage of pipe clay gumlands is that their pastures stand up better to dry weather than do those on the more fertile volcanic soils found in the same localities. A disadvantage of these podzols is poor water supply for stock and excessive pugging in winter. Farms containing both pipe clay gumlands and volcanic soils are ideal for these reasons.

The deeply leached gumlands somewhat resemble a sand culture to which everything must be added or may have to be added in the near future to obtain optimum growth. Lime, phosphate, potash, molybdenum, copper, manganese, and boron may all need to be added in future to obtain first-class pasture.

Lime requirements are not high when the extreme acidity of the virgin soils (pH 4.1 to 4.8) is considered. It is necessary to raise the pH values by about one unit or a little less. This is done by the ploughing in of 1½ to 2 tons of lime per acre in the gumland pipe clays and probably with a little less on the sandy gumlands (Wharekohe sandy loam). Maintenance dressings are estimated to be 1 ton per acre every 4 years.

Superphosphate or serpentine superphosphate is commonly applied at 3cwt. per acre three times in the first 12 to 14 months after virgin pipe clay gumlands have been converted into pasture.

The phosphate maintenance requirements of pastures on these soils have not been studied sufficiently in critical trials. Very likely they are not large, say, 2cwt. to 3cwt. of superphosphate per acre, and diminish as the residual phosphate level is built up by years of regular topdressing. Provided the recommended quantities of lime are applied, basic slag and North African phosphate are not superior to superphosphate; in fact they may be slightly inferior. Potash deficiency is general on the deeply podzolised pipe clay gumlands. Good pastures cannot be maintained for long without potash. The recommended rate of application is about 1cwt. of muriate of potash per acre each year.

Trials with molybdenum on pastures on Wharekohe silt loam illustrate the variability of the pipe clay gumlands. With a similar soil reaction a molybdenum response has been obtained near Kaikohe but not near Whangarei.

It is now being discovered that copper may be essential for vigorous pasture growth on some types of gumland, particularly where past lime has reduced soil acidity to a moderate level—about pH 6.0 and over. Boron and manganese may also become short on very heavily limed pastures and perhaps deficiencies of other trace elements may be brought to light in the next few years.

Soils Derived Mainly from Wind-blown Sands

Extensive areas of soils derived from wind-blown sand occur mainly along the west coast of the North Island.

The composition of the wind-blown sand is by no means uniform. Along the Manawatu coast it has only a little pumice ash mixed in, and in places is quite high in shell lime. Where the water-table is near the surface good pasture can be grown in summer with superphosphate; potash often gives further marked improvement, and lime has also been shown to be of benefit occasionally in spite of quite high original soil pH values (6.5 to 7.0). On the higher and drier parts of these sandy soils very light dressings of superphosphate may sometimes be payable to encourage subterranean clover. Low copper herbage levels have been found in some places and copper deficiency in cattle is suspected in certain areas. Pastures on some of the damp coastal sand flats of the Manawatu (Pukepuke black sand) may respond to applications of copper.

In Raglan County, west of the Waikato, and northward along the Auckland and Northland coastlines the wind-blown sands often contain a high but variable proportion of pumice and other volcanic ash. The presence of this ash and the warmer temperatures and higher rainfall have led to more rapid weathering of the sand or rather of the volcanic ash-sand mixture. Deep sandy loams and even sticky sandy clays occur.

The youngest sands around the coast are still little weathered, little consolidated, and droughty, except where the water-table is high. One trial on such a soil, Pinaki sand, is showing pasture responses to copper, magnesium, and possibly zinc. The older soils farther inland form sandy loams and clays, well drained, not particularly droughty, and capable of carrying good white clover-ryegrass-paspalum pasture. Typical of this group are the Red Hill sandy loams and clay loams.

Pastures on the Red Hill sand often respond to applications of lime in spite of apparently satisfactory soil reaction (pH 6.0). This is now thought to be due at least partly to a slight molybdenum deficiency. The parent material of the Red Hill soils, however, is too variable to postulate that this molybdenum deficiency is at all general. The only other pasture response to molybdenum on coastal sand soil has been obtained near Wellington.

Superphosphate or serpentine superphosphate seems the best phosphatic fertiliser to use on Red Hill soils. Potash deficiencies are uncommon, but are quite likely to develop on fields regularly used for hay and silage crops.

Finally there are large areas (about 160,000 acres) of sandy gumlands (6) north of Auckland—between Muriwai and Hokianga and north of Mangonui and Kaitaia. Te Kopuru sand is the main soil type in this group. Kauri forests have destroyed their structure and depleted their plant nutrient reserves. The sandy gumlands soils are true podzols; they are as poor in plant nutrients as the pipe clay gumlands. This in itself would not hamper their development. Unfortunately, however, Te Kopuru sand has often an impermeable, hard pan near the surface which makes the soil wet in winter and dry in summer. Where this hard pan is not strongly developed, however, quite good pastures suitable for fat lamb farming and even dairying can be maintained. As undeveloped Te Kopuru sand is very acid, lime requirements are usually about 1 to 1½ tons per acre initially. Of the major elements phosphorus as well as potash is needed to obtain reasonable pasture establishment.

Pastures on Te Kopuru sand have responded to applications of a few trace elements, particularly of copper sulphate at 5lb. to 10lb. per acre. Molybdenum also has slightly increased pasture vigour and vanadium has been promising enough to merit further investigation. Copper sulphate should be applied regularly to Te Kopuru sand. Its use is not only desirable because of its beneficial effect on pasture growth, but above all because it will prevent the copper-deficiency symptoms in stock so commonly found on this soil type. For reasons of stock health molybdenum should never be used on pastures on Te Kopuru sand and other sandy gumlands unless copper is also applied (3).

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Ryegrass Staggers Prevalent in Autumn after Dry Summer

By M. C. ARMSTRONG,
Veterinarian, Department of Agriculture, Timaru

THE widespread incidence of ryegrass staggers in sheep flocks in South Canterbury last autumn worried many farmers who had had little or no experience of this complaint previously. The disease was first reported early in February and the greatest intensity occurred during the last week of March and the first 3 weeks of April.

A 6-tooth ewe well down in a seizure.

RYEGRASS staggers is a disease which causes a disturbance of the neuro-muscular co-ordination, resulting in spasms or convulsions of muscle tissue. This type of convulsive staggers occurs in sheep, cattle, and horses of all ages, sexes, and breeds. It occurs in most parts of New Zealand and some parts of Australia.

Occurrence

The incidence varies from year to year according to seasonal conditions and is highest in years with a dry summer and autumn. Up to 75 per cent. of a sheep flock may be affected, but fortunately less than 1 per cent. die and most deaths are due to affected animals drowning in drains or creeks. Dairy cows are less often affected than sheep, beef cattle, or calves.

Ryegrass-dominant pastures are responsible and both perennial and short-rotation ryegrass have caused outbreaks. The staggers is most commonly seen when the ryegrass pastures are dried up after a drought when little or no green growth is present or soon after rain when growth is coming away again. Outbreaks of staggers are not uncommon, however, on longer, green pasture such as hay aftermath, and one severe outbreak occurred in South Canterbury on 6in.-to-8in., rank, green, spring-sown pasture fed during the following summer.

Symptoms and Pathology

Symptoms vary widely in severity, from slight stiffness of the limbs when animals are driven to complete inability of animals to stand or to make any sudden movement without falling. The commonest form is that in which the animals show no abnormality until they are driven or disturbed, when they show a characteristic stiff, bounding action for a few paces and then fall. Sheep usually run with a stiff-legged gait with both forelegs and hindlegs in unison and the head held high. Calves may run normally until the spasm occurs, when they usually have the legs bunched together under the body and leap from side to side before falling. The milder symptoms usually cause no loss of condition or deaths except from accident, such as drowning; even severe symptoms rarely cause death, and when they do it is probably from starvation.

On falling the animals may struggle, show spasmodic convulsions, muscular tremors, and twitching and rolling of the eyeballs. Relaxation soon occurs, and after a few minutes, during which grazing may be attempted, they rise, and if not again disturbed, resume normal walking and grazing.

Symptoms may appear a few days after stock enter the pasture on which the disease develops, and may disappear in from a few days to 2 or 3 weeks whether or not the stock are given a change of feed. Symptoms rarely persist for more than 2 or 3 weeks even if the stock are left in the same paddock as that in which the symptoms developed, especially if rainfall is sufficient to produce a good growth of pasture, thus altering the nature of the herbage being grazed.

No macroscopic or microscopic lesions have been found in numerous affected animals which have been examined. No abnormality of the blood content of calcium, magnesium, ketone bodies, phosphate, or sugars has been found in affected animals.

Treatment and Prevention

No satisfactory treatment is known for ryegrass staggers and it is fortunate that normal, spontaneous recovery occurs whether the feed is changed or not.

Movement of the affected stock to alternate forage is the usual treatment recommended, but is often hard to arrange and in many cases apparently unnecessary. The dangerous stage in the pasture appears to be of fairly short duration in most cases, though it may last up to a fortnight in some. When sheep or beef cattle are being moved to alternate pasture care is necessary not to drive the stock too fast, and one of the best methods is to leave the gates open, keep men and dogs away, and let the stock find their way through in their own time.

Causative Agent

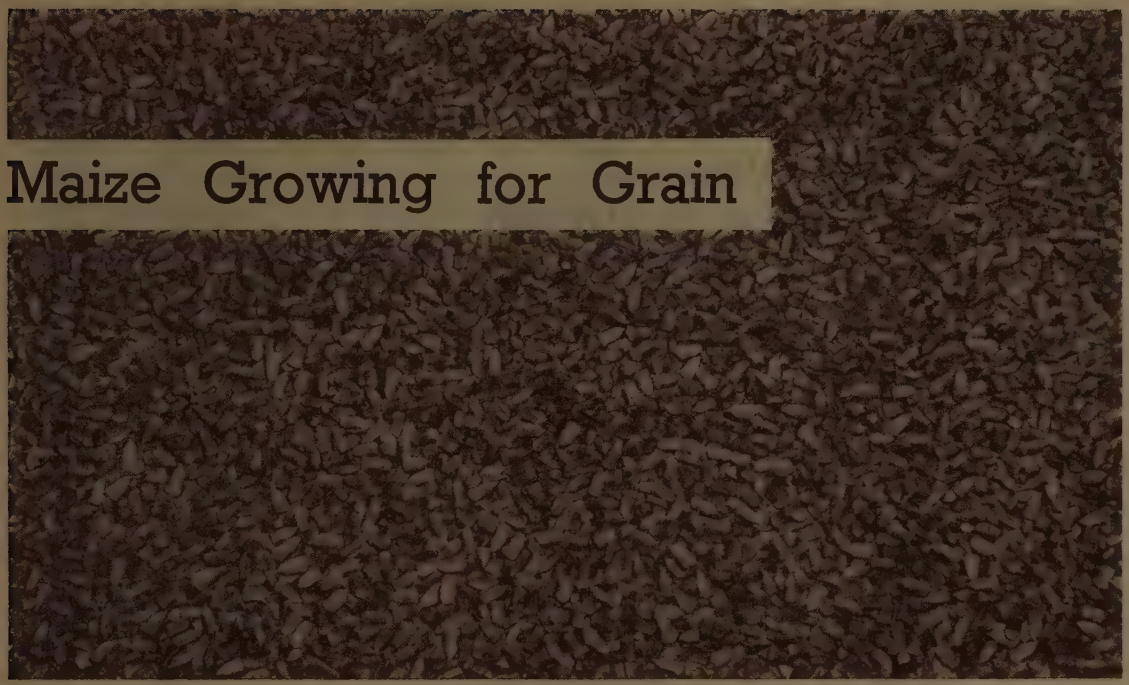
An unidentified agent in the pasture causing ryegrass staggers has been confirmed at the Department of Agriculture Wallaceville Animal Research Station by feeding experiments with grass cut from paddocks in which severe outbreaks of the disease have occurred.

Many theories have been advanced and tested regarding the causative agent of ryegrass staggers. Among these is the ergot theory. This may be disposed of by the fact that ryegrass ergot produces only ulceration of the tongue and stomachs in sheep and necrosis of the feet in cattle. Furthermore, many outbreaks of staggers have occurred in ergot-free ryegrass pastures. At present the most that can be said about the causative agent of ryegrass staggers is that it appears to be a product of a particular set of growth conditions in the plant, and future research into the pathogenesis of this disease is necessary to elucidate unknown factors.

Management of Affected Flocks

As mentioned previously it is advisable to shift the flock quietly to a paddock with the minimum of drains or water holes to lessen the chance of drownings. Dipping or drenching may have to be postponed in badly affected flocks. Where the incidence is light the affected animals can be shedded off after a stir-up and drive. The unaffected ones can then be drenched or dipped and the affected ones isolated and treated in 2 or 3 weeks' time when they have recovered.

Maize Growing for Grain



By H. de O. CHAMBERLAIN,
Instructor in Agriculture, Department of Agriculture, Gisborne

PROVISION of adequate suitable storage is important in the growing of maize for grain. This aspect of maize growing, the control of pests and diseases, seed maize, and use of maize on the farm are dealt with in this concluding part of an article on growing maize for grain. Preparation of land, attention during the growing period, and harvesting were discussed in last month's "Journal".

AFTER harvest storage space must be provided for the cobs. Maize freshly brought in from the field is not fully mature and still contains an excess of moisture, which must be dried out of the cobs before the grain can be safely shelled and stored in sacks. To give protection from rain and at the same time allow for free circulation of air through the cobs the maize is stored between harvest and shelling of the grain in specially designed buildings known as cribs.

The time the maize has to remain in the crib before it is ready for shelling varies with the weather. In windy, dry seasons it may be ready in 6 weeks to 2 months, but in wet, cold springs with little wind it may take several months. Shelling of the maize once the cobs are dry may be continued as other work permits and to meet market requirements through spring and summer and even into the following autumn right up to the time the next crop is ready for harvest. Cribs must therefore be strong, weatherproof, and adequate for the crop.

The main requirements of a good crib are:—

1. It should be made as weatherproof as possible by having a good overhang at the eaves and, if possible, by being placed in a situation sheltered from the direction from which wet weather mainly comes.

2. It should be vermin proof and raised well off the ground.

3. It must provide ample aeration for the maize.

4. The roof must be easily removed to allow filling from the elevator down the whole length of the crib.

To gain all these advantages for a permanent crib the floor must be well supported with concrete piles or wooden ones shielded on top with tin and the walls should be of fine-mesh wire netting placed on the inside of a strong framework so that the inside width of the crib does not exceed 5ft. The height from floor to front eaves should not exceed 10ft. with a height at the back of 9ft., as otherwise the weight of cobs will cause excessive packing with consequent sweating and heating and the development of mould in the cobs which occurs under these conditions. The length of the crib will depend on the area of maize. Roofing iron should be 8ft. long to provide sufficient overhang at the eaves.

An inside width of 5ft. is now recommended in place of the usual 6ft. of the standard crib. Cribs 6ft. wide were satisfactory with open-pollinated maize, which is harder to shell than the hybrids, and for hand picking, when the cobs are put into the cribs in sacks and spread by hand. With more easily shelled types of maize and the use of an elevator which drops the maize through the open roof, a considerable amount of loose maize falls into the crib and blocks some of the crevices between cobs. To get quick and satisfactory drying, therefore, the inside width should not exceed 5ft.

Portable Cribs

Maize growers are realising the importance of growing crops of maize in a rotation to reduce the risk of disease and prevent the spoiling of soil structure through repeated use of the same area. A disadvantage of using new areas is that often it results in long hauls from field to crib and unnecessary damage to the field containing the crib. This is obviated by the use of cribs strongly built in short sections which can be transported from paddock to paddock as needed.

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Maize stored in a series of portable cribs.

Each section is built on 9in. x 4in. floor bearers curved at the ends to form skids. They are 12ft. to 15ft. long, 5ft. wide inside, and 10ft. high in front and 9ft. high at back. As many sections are built as are necessary to house the crop.

Apart from the fact that the cribs can be moved they have the advantage that in a year of a short crop or possibly a smaller acreage one unit can be discarded, which ensures that all cribs are more evenly filled and there is less chance of damage than where a large crib is only partly filled. The chief disadvantage of a portable crib is that the floor is nearer to the ground than is desirable where flooding is a possibility, but this is easily outweighed by other considerations.

Maize Seed

Hybrid Maize

The use of what are known as open-pollinated varieties of maize for both grain and forage production has been discarded throughout the U.S.A. and in many other maize growing countries as a result of the development of much higher yielding, more vigorous, and uniform types of maize which have been produced by plant breeders and are known as hybrids. Most countries growing large areas of maize have established breeding centres for the production of hybrids suitable to their climatic and soil conditions, and seed for commercial use is grown under contract.

Because of the relatively small acreage of maize in this country and the high cost of maintaining a breeding centre the Department of Agriculture has taken advantage of the wide selection of hybrid maize available in the U.S.A. and has through trials selected hybrids suitable for conditions in New Zealand. The Department imports sufficient seed of the single-cross parents of the selected hybrid to grow enough double hybrid seed for commercial seed requirements.

The growing of the double hybrid is carried out under supervision by contract growers, and after careful sorting, grading, and cleaning the hybrid seed is made available to growers through merchants. New and improved strains of hybrids are continually being produced by plant breeders in the U.S.A. and trials with these and others are being continued by the Department with a view to selecting still better strains for New Zealand.

The first variety made available under this scheme, Pfister 360, has proved very popular with growers for several years. A second variety, Wisconsin 643, is now in production and because of better disease resistance, stronger stalk, and higher yield it is expected to replace Pfister 360.

The double hybrid, provided the selection is made of a type that has a maturity period which fits into the growing season of the particular district in which it is to be grown, has many advantages over the old, open-pollinated varieties. Among the most important are higher yield (up to 20 to 30 per cent.), the direct result of the increased hybrid vigour, more uniformity in type of growth, in height, and number of ears and in grain size and colour, greater vigour of seedlings, and easier husking and shelling. The hybrids are also selected

Method of securing roof of maize crib with 4in. x 2in. cross-pieces wired together at the ends. This is done to avoid nail holes in the roofing iron.

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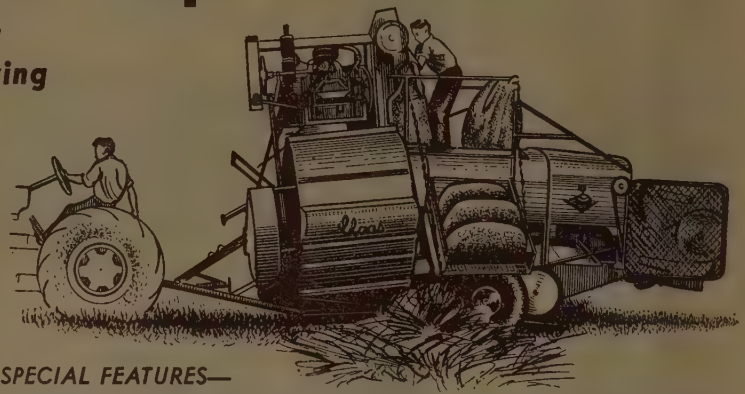

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for resistance to disease and for strength of stalk. Further improvements along these lines are continually being made.

However, there is one very important point in which the hybrids differ from the old varieties: They lose their vigour rapidly if grown on from seed saved from a crop in the field. This fact has resulted in the standard practice of growers buying fresh seed of the double-cross hybrid every season, and New Zealand growers of hybrid maize varieties should very definitely follow the same practice.

The experience of maize grain growers with the results of hybrid maize seed as produced by the Department and of merchants handling their produce is such that it should not be long before such open-pollinated varieties as Marigold, Early Butler, and Motiti, which are still grown in some places, are discarded in favour of the double hybrids.

Diseases

The common practice of growing maize year after year in the same paddocks has caused a gradual build-up in the soil of various fungous diseases. To some extent the effects of this have been restrained in Poverty Bay by silting from river flooding of many of the areas concerned. Over the last 3 years, however, the fruits of this malpractice have become a danger to economic maize growing, owing to the rapid spread of some diseases. Though the Department of Agriculture is already taking all possible steps to minimise the effect of diseases by the selection of resistant hybrids, this cannot be wholly successful unless farmers adopt a new and modern attitude toward crop hygiene and the rotation of crops.

Filling maize crib with elevator.

Head Smut

Head smut of maize (*Sorosporium reilianum*), present in small quantities for many years, has increased over the last few years to an extent where infections of over 20 per cent. have been observed. It occurs on tassels and cobs, where considerable distortion is caused, followed by the characteristic heavy covering of sooty black spores, which are carried in the wind to clean areas and are also spread during harvesting.

Experiments have shown that dressing the seed with mercurial dusts is only partly successful. Infection can occur in seedlings or young plants from spores in the ground. No visible symptoms are produced until the development of the flowers, in which the disease causes distortion and later produces masses of black spores.

Crop rotation and sanitation and the search for resistant varieties are of highest importance, since only by these means can the amount of infectious material be reduced in the field.

Leaf Blight

Traces of leaf blight (*Helminthosporium turcicum*) also have been

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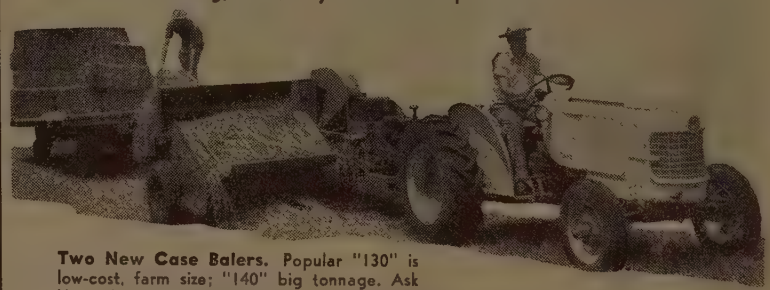

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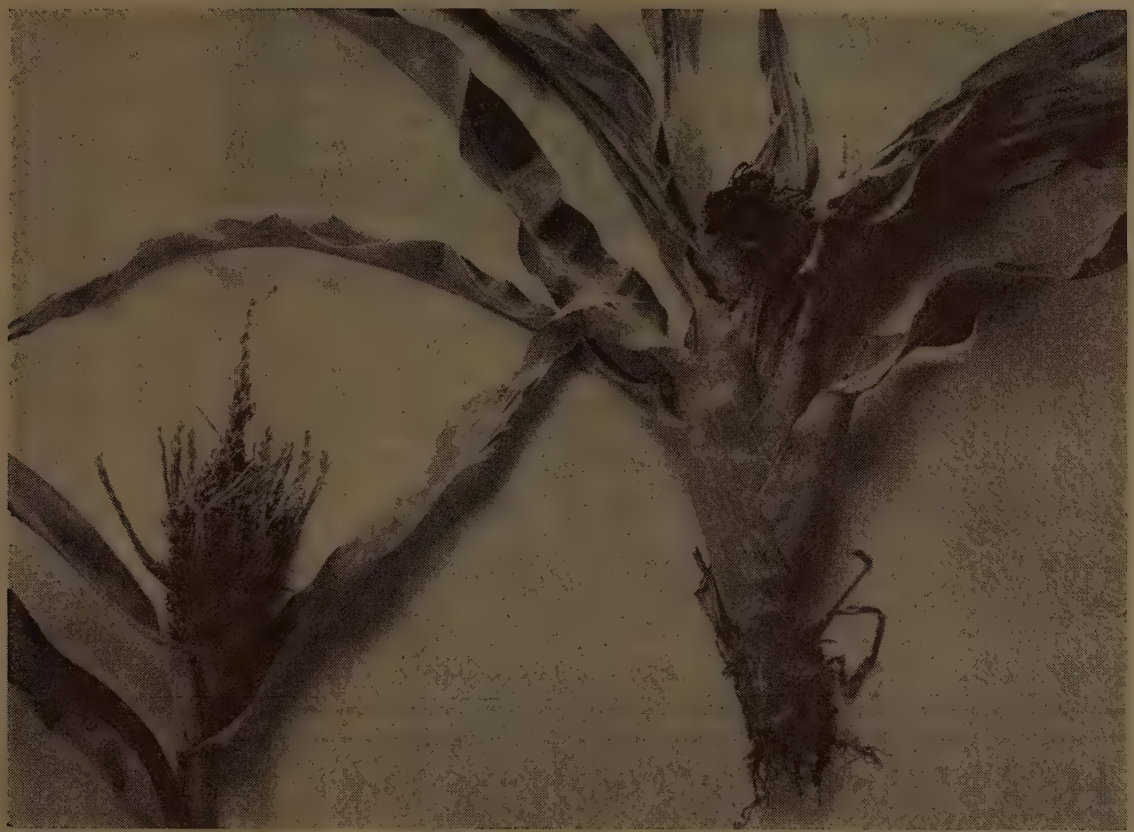

Left—Typical smut infection of tassel. Right—Distortion of plant owing to smut infection.

evident for some time in the Poverty Bay district, but only over the last 3 years has it assumed epidemic proportions. Traces have also been found in the Bay of Plenty and South Auckland. It is probable that proper rotation of crops, control of weeds, and early ploughing after harvest could prevent the spread of the disease in these areas.

The symptoms of leaf blight ordinarily become evident about January as elongated, straw coloured, dry blotches on the leaves. At first these blotches are small, ½in. or less long, but they enlarge rapidly and extend until the whole leaf has a scorched appearance.

Leaf blight is spectacular in epidemic form, but is not perhaps as important as growers now believe. If the weather is suitable and young plants are attacked, much damage can be done. Early maturing varieties seem particularly susceptible. Heavy attacks appearing from February onward, though certainly reducing crops, do not damage the yield as severely as would be expected from the appearance of the foliage. Moreover, crops thought to have been affected by leaf blight by growers have shown only the somewhat similar appearance of "firing", caused usually by lack of moisture or plant food or by some biological interference with the conversion of plant foods within the plants.

Control: The most effective long-term means of controlling the effect of leaf blight is by use of resistant varieties. Wisconsin 643 has definite possibilities in this way. On a general and short-term basis every endeavour should be made to carry a fire through the maize stubble as soon as harvest is complete and to plough deeply immediately afterward. Care should be taken not to sow in spring, except on a well-prepared seed-bed, and not until the soil is sufficiently warm to give quick germination and continuous growth. Slow germination and checking of growth caused by a cold snap after too early sowing predisposes the young maize plants to attack.

Rotation of crops should always be practised, a new maize paddock yearly being preferable, and certainly not more than two crops should be grown in succession.

Crops grown between maize crops should be brassicas or peas, beans, lupins, etc. Grain crops such as wheat, oats, or barley, even for greenfeed, should be avoided, since they may carry the spores of stalk rot.

Stalk Rot

Stalk rot (*Gibberella* and *Fusarium* spp.) infection is increasing in Poverty Bay and causes most of the lodging in maize. Apart from causing stalk rot in fairly mature plants, the fungi can attack seedlings and cobs.

Fungi of this type cause considerable loss in the early growth in some seasons from seedling blight whereas in other seasons they are of little or no importance. Seed treatment is effective where the crop is sown on

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a clean paddock, but is of less value in sowings which follow infected maize.

Seed infected with *Gibberella* may result in very patchy stands and much seedling blight in early sowings, especially where they are followed by periods of cold weather.

Young diseased plants carefully dug out show the kernels to be of a characteristic reddish colour with a dark brown spot.

On mature stalks the infection can be found, usually close to the ground, in the appearance of a brownish area sometimes all round and sometimes on one side only. This, in the later stages, causes the plant to mature earlier than unaffected ones and finally to fall over at the point of infection, causing the typical stalk break.

Control of this disease is effected by seed treatment and by the planting of maize in land out of pasture or after a crop other than maize or any of the cereals which also carry the *Gibberella* spores. Burning of crop residues, including chaff, husks, and shelled cobs, followed by deep ploughing assists materially in checking this serious disease.

Insect Pests

Cutworm

In Poverty Bay the chief insect pest is the cutworm, which attacks the maize at almost any stage from 4in. to 18in. high. The caterpillars cut the stalks neatly off close to the ground, leaving the plant lying beside its roots. They do not appear to eat the foliage. In some years cutworm has caused enough destruction to necessitate resowing of the crop.

Attacks are encouraged by late and hurried cultivation and the presence of heavy trash in the soil. Early cultivation with a winter fallow serves to reduce infestations to a marked extent. Many methods of control have been attempted, including dusting with 5 per cent. DDT, spraying with DDT emulsion, and laying lindane baits. Quite good results have been obtained in some years by all methods, but weather seems to be the determining factor and no method yet attempted is consistently successful. Lindane baits are made by mixing 2lb. of 16 per cent. lindane with 100lb. of bran and 2 gallons of 20 or 30 grade motor oil. The mixture is used at 10lb. to 15lb. per acre.

Aphis

Aphis attack is generally seasonal, but early appearance of the pest before the cob is filled can cause cessation of growth and a reduction of yield. Since the attack does not occur until the plants are nearly full grown, no method of control has yet been practised.

Smut infection; thickened base of cob (left) and cob split to show infection (right).

Green Vegetable Bug

In recent years the green vegetable bug has become widespread in all maize growing districts. It strips leaves and punctures grain on the cobs. Control by sprays and dusts is impracticable, but it would appear from results so far attained that control by a parasite will be successful.

Grain Weevil

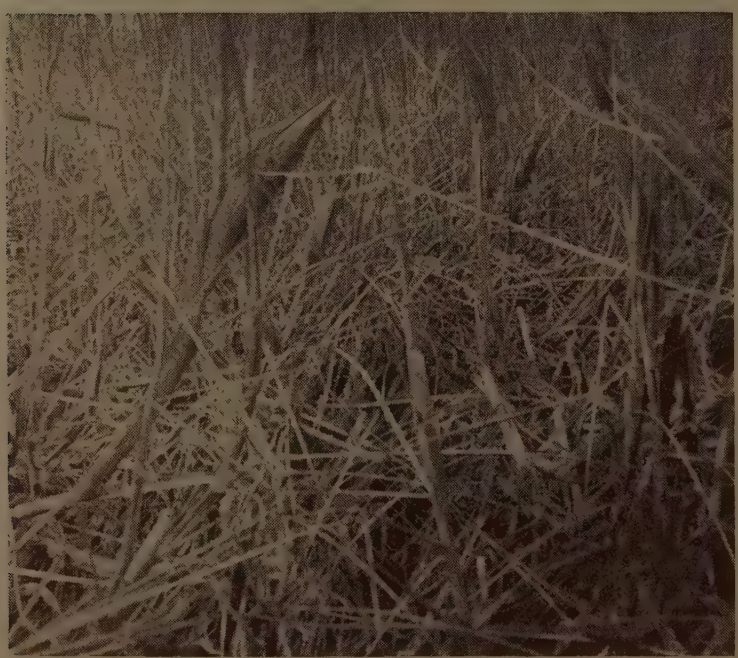
Grain weevil in stored grain is a nuisance once it is established, but attacks can be prevented by dusting the sacks well with 5 per cent. DDT dust as they are being stacked. This should become standard practice because once the weevils are in the grain, nothing short of pulling down the stacks and prolonged fumigation will kill the weevils.

Other Pests

In Bay of Plenty the army worm is the most serious pest. These caterpillars move in thousands on to a crop and eat all green parts, including immature cobs. In the rare event of an attack at an early stage of growth good control can be attained by spray-

▲ Cutworm damage in maize. The caterpillars cut the stalks off neatly close to the ground, leaving the plant beside its roots.

▼ A crop heavily attacked by army worms.



ing by tractor-operated machinery with DDT emulsion. At a later stage, but before the crop is at its full height, aerial spraying is effective. Once the crop is fully grown, however, to gain good coverage of spray seems impossible and control is very difficult.

The Australian soldier fly has attacked the roots of crops in the Opotiki district, but does not as yet appear to have spread far afield. Prevention of attack is achieved by early ploughing to expose the grubs and by keeping down all rough growth on prospective maize areas.

Use of Maize on the Farm

Most maize grown is eventually fed to stock, generally for the production of pig meat and eggs. As the starch content of maize is very high, it provides a useful foodstuff when fed with skimmed milk or meat meal. Occasionally the grain is cracked and used as a substitute for oats in the ration of working horses or ground finely and employed in calf meals. In pig farming it often provides the means for farmers to carry autumn-farrowed litters through winter at a relatively low cost for foodstuffs.

Feeding to Pigs

There are various methods of feeding the grain, some farmers even turning their pigs into a standing crop, a method which is extremely wasteful of grain. Others throw unshelled cobs to their pigs or feed the shelled grain either in troughs or scattered on the ground. None of these methods can be recommended. Untreated grain is not easily digested and much of it passes through the animals whole or almost whole.

Where pigs are fed on open-range pasture through winter they may be fed by scattering grain on the pasture, but it is far more economical to treat the grain by soaking or boiling it before feeding it to the stock. Where soaking is to be done the grain should be left in barrels for 24 to 48 hours to soften it thoroughly before it is fed to pigs; if it is boiled, the grain becomes jelly like when ready for feeding.

Pigs on grass will do quite well on 1lb. of grain per day, but for later topping off the amount should be at least trebled. Pigs carried through winter as stores require about 2 to 2½ bushels of grain each.

Feeding to Poultry

The general opinion among poultry keepers seems to be that maize when fed with a good supply of skimmed milk provides quite a good ration for laying birds. Maize alone tends to cause undue flesh formation with a consequent reduction in egg production.

Ground Water in the Waikato

By J. C. SCHOFIELD,

Geologist, New Zealand Geological Survey, Department of Scientific and Industrial Research, Ngaruawahia

GROUND water is the principal source of farm and domestic water supplies in the Waikato area (Fig. 1) and with the growth of spray irrigation must become increasingly important in the near future. This article shows how the quantity and quality of ground water are related to the sediments (greywacke, limestone, papa, sandstone, soft sands, and silts) from which it is obtained. Different sediments are related to different topographic reliefs and a guide is given to enable the farmer to tell the type of sediment which underlies his farm and hence the amount and quality of water he is likely to obtain by drilling.

THE Waikato region is broadly divisible into three ground-water areas: (1) Where only small supplies of a few hundred gallons per hour are available; (2) where larger supplies are available; and (3) where ground water is either not present or specialist advice is necessary to obtain the little water available. Areas within the last category need individual attention, and little help can be given in this short article. A more detailed account of these three areas will be included in a Geological Survey bulletin describing the central third of Fig. 1.

The effect of prolonged use of iron-bearing water on pastures is not

HEADING PHOTOGRAPH: The gentle, rolling downs in the foreground are underlain by Hamilton strata of older Pleistocene age. The high country in the background is made up of Tertiary sediments and greywacke. The view is from Koromatua.

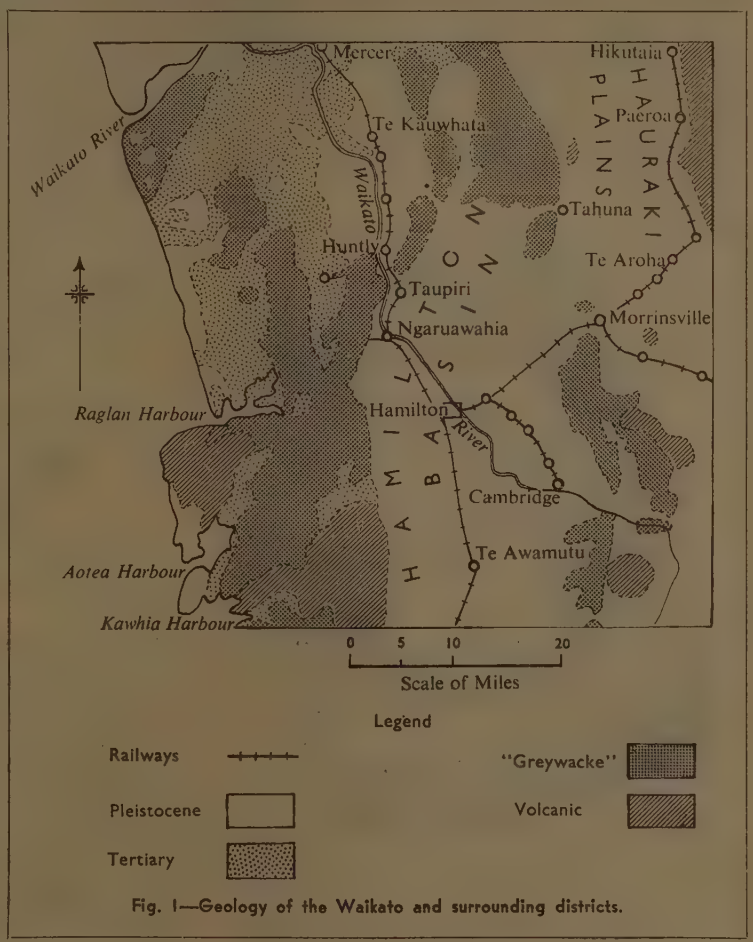
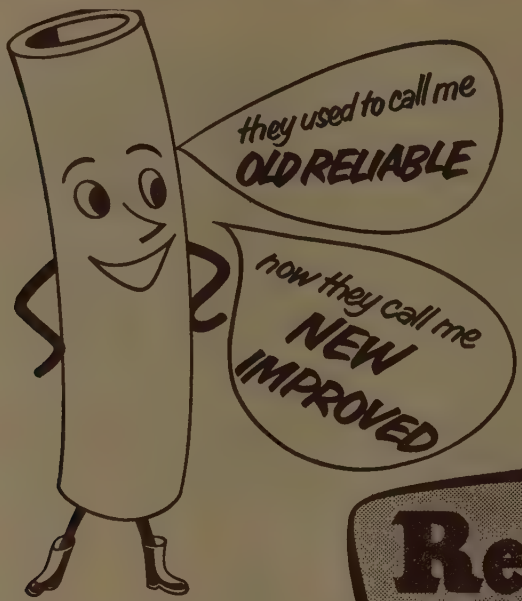


Fig. 1—Geology of the Waikato and surrounding districts.



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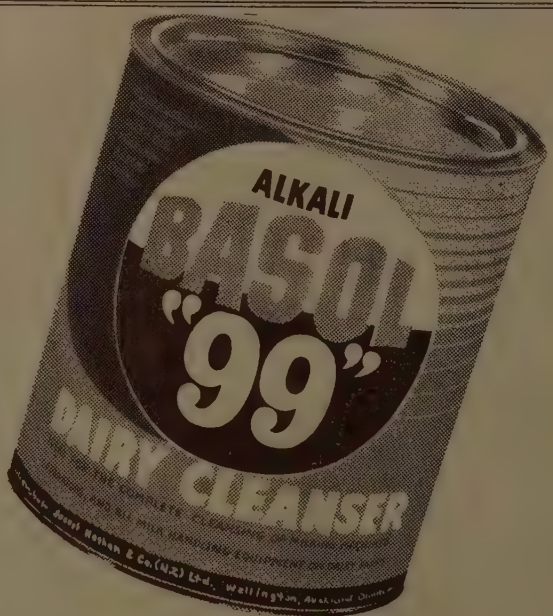

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Fig. 2—This view in the Waingaro Valley shows in the background the typical steep and hummocky relief of greywacke.

known, but its troublesome nature, causing blocking of pipes and staining, is common knowledge. Ways of improving such supplies are suggested.

Possible lowering of the water-table by increased use of ground water is of topical interest and hence a short section at the end of the article is devoted to this problem.

Geology Versus Divining

The prevalent belief in water divining is undoubtedly helped by "remarkable" successes. Such are readily explained, however, since in New Zealand water is obtainable from any position within approximately 90 per cent. of the Waikato area. Within the remaining 10 per cent. diviners make their mistakes, which are to be forgotten, it seems, by all except the farmer concerned and perhaps some geologist whose opinion has been asked for as a last resort.

Every geologist knows that water divining often leads to unnecessary expenditure. Most drillers in the Waikato no longer believe in it; they know that time and time again farmers pay unnecessarily for extra piping and power installation so that a drill hole might be placed at some divined spot. It is thus to the advantage of a user of ground water to have some understanding of the source and movement of ground water.

Ground-water Origin

There is no mystery attached to the origin and movement of water in the ground. All but the smallest fraction is derived from rainfall. A part of the rainfall is lost to surface run-off, evaporation, and plant transpiration, and the remainder enters the ground. There some is retained near the surface by capillary action and is available for plant life. The rest seeps downward and becomes part of that great body of water which saturates the sediments and is known as ground water.

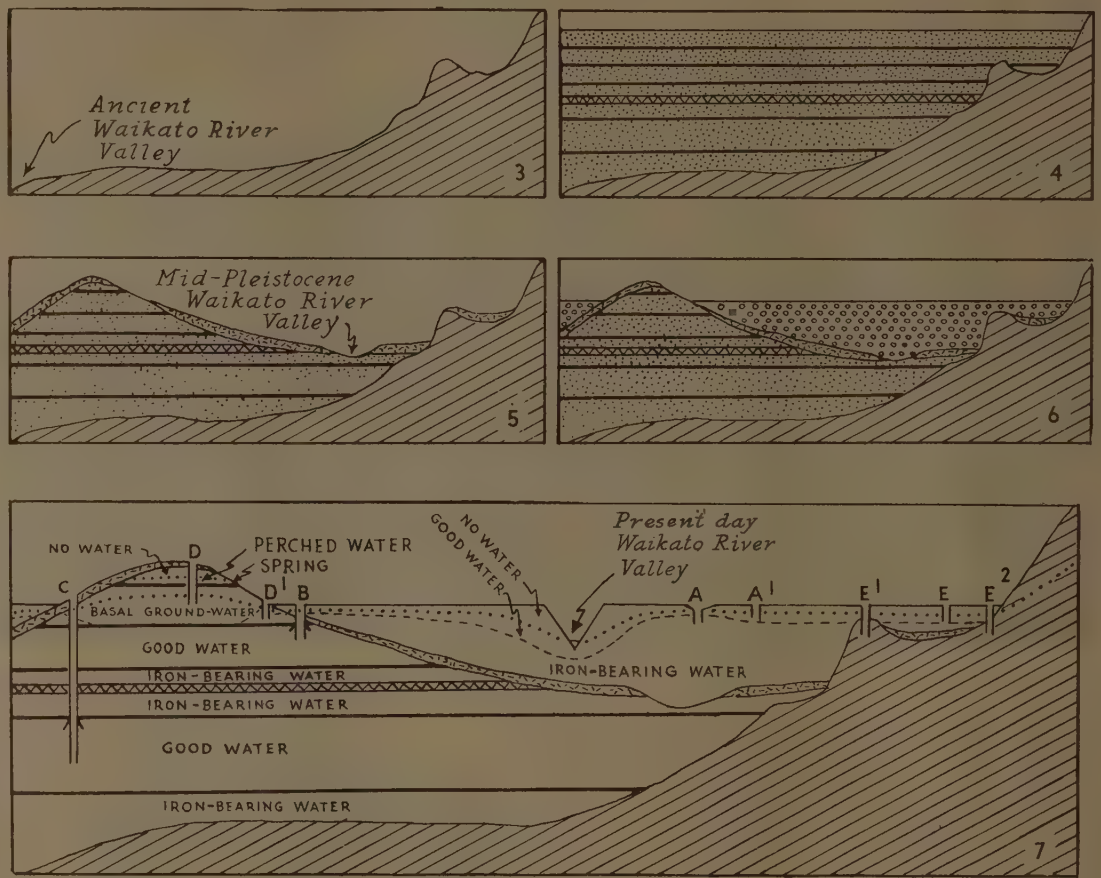
Occurrence and Movement of Ground Water

The term artesian is commonly but mistakenly used to embrace all types of ground water, whereas there are two important categories defined as free and confined, the latter being truly artesian.

Free ground water exists where the sediments above it are pervious. The surface at which the unsaturated sediment meets the lower, saturated sediments is known as the water-table, which roughly follows the shape of the ground surface (Fig. 7) and rises and falls with variation in rainfall.

The water-table is not constantly becoming higher and therefore ground water must flow to some outlet. Under natural conditions it is dispersed by springs, evaporated from swamps, or moves toward and enters streams at their water level. As with surface run-off the movement of ground water is controlled by gravity and hence the water-table slopes toward surface streams or springs. Ground water differs from surface run-off, however, in that it moves slowly as a sheet of water at a rate of a few feet per day. Most of the movement is confined to the upper part and thus in thick, pervious sediments the ground water can be divided into an upper, moving part and a lower, more stagnant part where more mineralised waters may be present (Fig. 7).

Confined ground water is overlain by material sufficiently impervious to prevent any free connection with overlying ground water (Fig. 9) and may yield artesian flows of water as surface springs or from drill holes. Any upward movement of water is due to the hydraulic pressure developed between the intake (Fig. 9) and outlet. Hence the pervious stratum which contains confined ground water can be looked on as a natural conduit which is subject to all the conditions of outlet, size, friction, etc., of any man-made water-pipe. Under many confined water conditions there may



Simplified geological history and formation of strata of Pleistocene age.

Fig. 3—Pre-Pleistocene topography.

Fig. 4—Hamilton strata deposited.

Fig. 5—Hamilton strata eroded and volcanic ash deposited.

Fig. 6—Hinuera strata deposited.

Fig. 7—Present-day erosion in Hinuera strata. So that the relationship of good and iron-bearing waters can be shown the scale of Fig. 7 is double that of Figs. 3 to 6.

be almost no outlet, which results in highly mineralised water.

Quantity Available

The amount of water available from a rock or sediment depends on the thickness and permeability of the rock or sediment; that is, its capacity to transmit water. Thus, because of larger pore spaces the permeability of a sandy stratum is greater than that of a muddy stratum.

These factors are unalterably fixed by nature and it remains for man to make full use of them. A test of a good driller is his capability to develop a drill hole after drilling, for the permeability of a sand or gravel bed may be impaired by his failure to clean it adequately, and, equally important, the actual supply from a poorly cased and screened hole will be much smaller than the potential supply. Properly designed screens for each type of sediment may mean the difference between success and failure, especially where large supplies are required.

In the past, when mostly small supplies were required, rough and ready drilling methods worked satisfactorily. In the future, too, this type of drilling will satisfy the demands of many customers. However, now that spray irrigation is spreading and more public bodies are becoming interested in ground water, larger supplies are called for and the driller who employs advanced techniques will be favoured.

The diameter of a well or drill hole does not greatly increase the amount of water available. Under average conditions a 12in. well will yield 10 to 15 per cent. more water than a 6in. well, while a 48in. well will produce 20 to 35 per cent. more than a 12in. well. Some fine sands, however, cause trouble and it is important to note that larger-diameter wells give less sand trouble.

Quality of Water

As already mentioned near-stagnant conditions adversely affect the chemical purity of free and confined ground water. Local factors such as surface peats, swamps, buried peats, and thermal waters can also affect the quality.

Generally ground water is organically pure, but it may be contaminated if wells are badly installed, are left uncovered and unprotected from stock, or are near dung heaps. A common source of contamination is the siting of septic tank outflows so that they discharge into ground water flowing toward a well.

The main despair of many groundwater users in the Waikato is the presence of undesirable quantities of iron salts. These cause pipe blockages and red-brown staining but are otherwise harmless. Their presence can be quickly shown by boiling the water; a brown-red or yellow precipitate indicates iron salts. Tea made with such water becomes black. Drillers can often tell from the colour of the sediment whether or not the water contains much iron; yellow, brown, and red drill cuttings denote iron-free water, whereas blue and green cuttings show the presence of iron in undesirable quantities. Usually the difference of colour is only slight, for the presence of good or iron-bearing water may affect only a very small percentage of the sand grains. Thus the over-all appearance may be grey, but if a few sand grains are brown, yellow-brown, yellow, or red, the associated water is probably good.

Water may be freed of iron by spraying it through the air and filtering it, though an easier and cheap method is to filter the water through a glassy phosphate contained in an attachment to the pump; these attachments are now available in New Zealand. Such water is not harmed for drinking, but as treatment is not always successful, a sample of water should be tested before equipment is purchased.

Waikato Ground Water

The following descriptive groundwater summary applies to the area shown in Fig. 1. The sediments may be divided broadly into three types: Indurated greywacke, moderately consolidated Tertiary sediments, and loosely consolidated Pleistocene sediments, of which typical landscapes are shown in the accompanying photographs.

Ground Water from Greywacke

Unweathered greywacke is the hard, blue-grey rock that is used for road metal. However, in the steep country, such as the Hakarimata Range and the range of hills between Morrinsville and Cambridge, greywacke is exposed mainly in its weathered state, in which it ranges in composition from clays (the most weathered form) to a yellow-brown, rubbly rock commonly known as rotten rock. Greywacke is able to hold water only because of cracks and crevices which are mainly confined to the upper rotten rock zone. The blue rock below rarely contains a sufficient number of cracks and to drill far into it is nothing short of an expensive gamble. Supplies average 150 to 200 gallons per hour, though they range from virtually nothing up to a maximum of 500 gallons per hour.

To its credit, however, greywacke normally yields water of excellent quality.

Ground Water from Tertiary Strata

The Tertiary strata, as for example at Te Akau and Glen Murray, include papa, sandstone, limestone, and coal. On the whole these strata are fairly impermeable and large supplies of water in them are rare. Quite often even small supplies are difficult to obtain and require special investigation. The water is usually hard.

Ground Water from Pleistocene Strata

The Pleistocene sediments are widespread and underlie the large Hamilton basin and Hauraki Plains regions (Fig. 1), where the topography consists of low, gently rising hills, flat areas, and large peat swamps. This type of topography lends itself to spray irrigation and it is fortunate that a drill hole can be placed anywhere to yield water, and commonly large supplies of up to 10,000 gallons per hour can be obtained from one or more drill holes or dug wells. However, on the margins of these regions the Pleistocene sediments thin out on to greywacke and Tertiary rocks (for instance, in the western and eastern limits of the greywacke range between Cambridge and Morrinsville). These fringe areas of the Pleistocene sediments have caused most requests for aid to be made to the Geological Survey and even small supplies of water cannot always be guaranteed. The best drilling sites are as far out into the Pleistocene sediments as possible, but even there some disappointments may be caused by buried greywacke and Tertiary hills that come close to the surface. (In Fig. 7 compare successful well E with dry holes E^1 and E^2.)

The quality of the ground water from Pleistocene sediments is variable, some waters having a high iron content. To account for this variation the geological history of the Pleistocene sedimentation must be examined. The Pleistocene sediments are divisible into an older and a younger set, known as Hamilton and Hinuera formations respectively. Both consist of pumice and other volcanic debris that were transported by the Waikato River when it flowed along ancient courses from the central volcanic region. Peats developed at intervals and were subsequently buried. A simplified geological history is shown in Figs. 3, 4, 5, 6, and 7. The Hamilton strata are readily distinguished from the Hinuera sediments by the difference in topography (see also accompanying photographic illustrations).

Good ground water within the Hinuera formation is restricted to its topmost part, that is, to a zone immediately below the water-table, which is usually at depths ranging from the surface to about 50ft. Below the good water, and near existing or formerly swampy areas, the water is highly contaminated with iron. The thickness of the good water ranges from nothing to many feet and is thicker under the slight rises within the plains (see photograph taken near Horotiu) and also in the vicinity of rivers. Thus one well may be yielding good water whereas another, a

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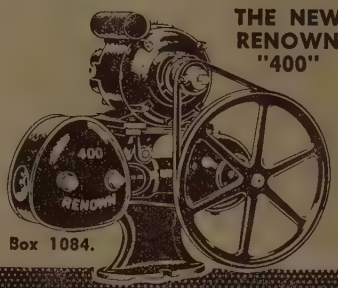

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chain or so away, may be yielding iron-bearing water (see wells A and A[1] in Fig. 7).

When a well or drill hole is sunk in the Hinuera sediments the thickness of the good water zone at the top should be carefully determined by watching for change in colour of the sediments (see "Quality of Water" section on page 71). A pumping test will soon show if there is sufficient good water present. Ample supplies of good water at shallow depths have been overlooked in many Waikato holes and have been cased off. In such cases further layers of good water may not be available and even if they are present within the Hamilton sediments below, the extra drilling and casing necessary may be considerable.

On the other hand it is fairly typical of the Hamilton sediments that there is alternation of good water with iron-bearing water owing to the presence of interbedded peats. Under these conditions the peat-containing strata should be cased off (see drill hole C in Fig. 7). Where iron waters are found in a drill hole that did not penetrate peats, and that is not near surface peats, deeper drilling for good water is not recommended. Under these conditions as much use as possible of the upper strata should be made by casing and screening. Only in those areas where ample good water is more easily obtained at depth is deep drilling justified.

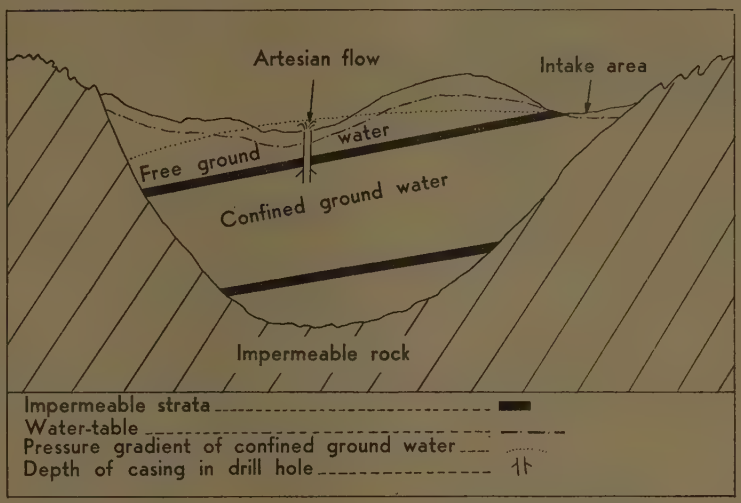

Fig. 9—Confined ground water, showing the relationship to artesian flow.

The ground water of Hamilton strata is commonly contaminated by nearby iron-bearing water of the Hinuera strata. Drillers have found that the best position for drill holes under such conditions is on or near the top of a hill composed of the Hamilton sediments (compare drill hole D with D[1] in Fig. 7). In other cases it may be possible to case off the iron-bearing water above an impervious layer (see drill hole B in Fig. 7).

The above notes are written as a guide and should be used in conjunction with a knowledge of local conditions which could be acquired from neighbouring drill holes.

Fig. 8—Tertiary sediments near Te Akau. The topography is intermediate in relief between that developed on greywacke and Hamilton strata.

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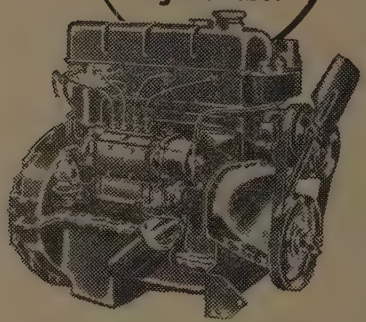

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Fig. 10—A view northward from near Horotiu, showing slight undulations of the plains which are underlain by Hinuera sediments.

Irrigation Effects on Water-table Level

If surface supplies are used for irrigation, care must be taken in using the minimum required by plant life (see "Summary of Recommendations" given by H. E. Annett in "The Economic Aspect of Spray Irrigation of Pasture" in the May 1951 issue of the "Journal"). Excess water will join the ground water, and if irrigation were widespread, the average water-table level would rise very slowly and low-lying areas might be converted into swamps.

When ground water is used the loss of water by evaporation and plant transpiration is important, for as a result the average water-table level will slowly fall until a new equilibrium is reached. If, say, 15 per cent. of the Hamilton basin were irrigated by ground water, such a fall would not be serious. Some surface pumps might need lowering, but on the other hand a fall in the water-table might be beneficial in swampy areas.

The water-table will continue to fall (giving the serious conditions experienced in some parts of the United States) only when the average loss of ground water exceeds the average gain from rainfall. This is unlikely in the Hamilton basin, where it appears that about 50 per cent. of the basin could be safely irrigated.

Intense irrigation in small areas, such as the market garden area of Rukuhia, may cause locally an initial rapid fall of the water-table. Nevertheless, a new equilibrium level for the water-table should be reached quickly and no serious, constant fall should take place. These considerations are based, however, on meagre information and, since irrigation will be important in the future economy of the Waikato, further information is very desirable, especially the weekly recording of the water-table level over at least 10 years. The Department of Agriculture's Animal Research Station at Ruakura and Soil Research Station at Rukuhia and a few interested farmers are making such observations. If any others are interested, they should write to the Director, Geological Survey, 156 The Terrace, Wellington.

Future Work

A geological survey of the Waikato region is in progress and a detailed account of ground water will be published in a bulletin of the Geological Survey. Farmers in this area who have not already contributed information regarding drill holes on their farms can help by sending to the Geological Survey, 156 The Terrace, Wellington, all or as much as possible of the following information:—

(a) Position of farm (for example, north of Paterangi-Te Awamutu road, ½ mile west of junction with Sing Road).

(b) Site of drill hole, whether on plains or hills.

(c) Driller's name.

(d) Description of strata passed through.

(e) Water level before and after several hours' pumping at a known rate.

(f) Depth to pump.

(g) Depth of hole.

(h) Length and diameter of casing.

(i) Quality of water with copy of analysis if available.

(j) Rate of pumping.

(k) Length, diameter, and type of screen.

(l) Any other particulars of interest, such as temperature.

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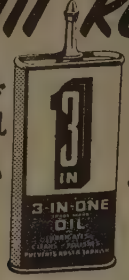

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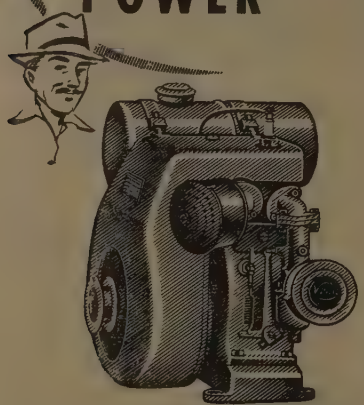

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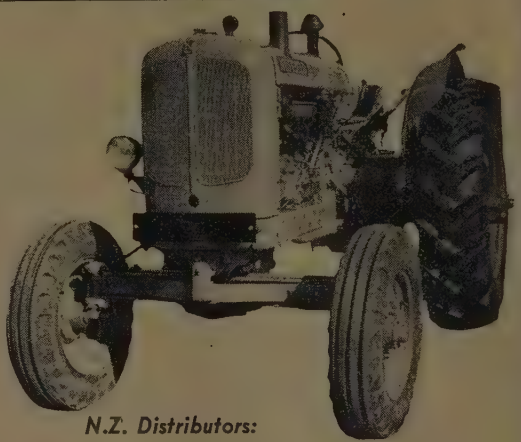

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Pasture Production in New Zealand

By P. B. LYNCH,
Field Crop Experimentalist, Department of Agriculture, Wellington

PASTURE production has been measured in trials at a number of places throughout New Zealand for several years past, and this article gives some idea of the type of information that has become available. As well as the over-all measurements of production, which are considered here, samples of the herbage cut are sorted into their component species so that the production of the individual pasture species can be estimated. A study is being made of the relationships between the various climatic factors, mainly rainfall and temperature, that influence growth in the field. The following summary, however, is concerned with the pasture production data only.

Mowing pasture herbage at Dargaville on the rate-of-growth trial.

MEASUREMENT of pasture production has for many years been considered one of the most difficult of field technique problems. The difficulty is to decide what is to be measured. The interval between each cutting (or grazing) has a very marked effect on total pasture production; so also has the height of defoliation, the defoliating implement used, and, indeed, all aspects of the cutting technique adopted. For these reasons it is **essential** to adopt standard methods if one wishes to make comparisons. The standard methods of the Extension Division of the Department of Agriculture are a 2-weekly cutting interval, the use of the motor mower as a cutting implement, and the use of a "trimming" cut before cutting for weighing.

In this work the primary interest is pasture production in different districts. It is necessary, therefore, as far as possible, to standardise the other obvious factors affecting production. These are, in the main, soil type, pasture type, fertilising, and grazing management. Most soil types are not found in all districts and it is necessary to consider the soil type as well as the district when district comparisons are being made. The soil type chosen for these trials is usually one of rather better-than-average fertility. To a considerable degree adequate and correct fertilising can overcome differences in production due to soil type, and all trials are well treated as regards fertilisers and lime.

The pasture type chosen is ryegrass-white clover dominant, though the Dargaville trial is paspalum dominant in summer. It is, of course, impossible to secure complete uniformity in pasture type in different districts. Use of a standard 2-weekly cutting interval and a standard method of defoliation makes it possible to overcome some of the causes of variation from grazing management. All trials, however, assume good grazing management of the trial area.

Total Yearly Production in Different Districts

The basic information with regard to yearly totals of pasture production from rate-of-growth trials from 1940 onward is shown in Table 1.

The figures given in Table 1 cannot be taken as giving an accurate indication of the productive capacity of the different districts owing to incomplete control over the variables mentioned. The Marton figures are too high. The trials from which they were taken were cut at a comparable stage of growth rather than at a regular cutting interval. The intervals between cuts would probably average nearer 4 weeks than 2. Evidence from technique trials indicates that the Marton figures should be reduced by at least one-quarter, which would bring them to a level comparable with those of the Hawera trial. New trials have now been started at Marton on strict rate-of-growth technique.

However, it may fairly be stated that good dairy pasture in the North Island should yield about 8000lb. to 10,000lb. of dry matter per acre per year. Production is lower at Stratford owing to cooler temperatures and higher at Dargaville under warmer conditions, a moisture-retentive soil, and a summer-autumn growth of paspalum.

Most variation from year to year is found at Dargaville, Hamilton, and Winton. The Taranaki trials, on the other hand, have more constant annual production; this is probably associated with a more reliable effective rainfall.

TABLE I—YEARLY DRY MATTER PRODUCTION (lb. per acre) OF PASTURES
(Period: May to May)

Location	No. of years	Mean yearly production	Range of production	Standard deviation
Dargaville	5	15,570	11,200-19,050	3,270
Hamilton	7	9,990	7,950-14,150	2,160
Stratford	6	6,100	5,100-7,400	910
Hawera	7	8,180	6,500-9,350	920
Marton	14	10,090	6,000-11,850	1,680
Gisborne	9	12,250	10,500-14,550	1,390
Winchmore (dry)	4	4,110	2,350-5,900	1,610
Winchmore (irrigated)	4	7,050	5,150-9,650	1,880
Invermay	3	7,820	6,100-9,150	1,560
Winton	12	8,480	4,750-13,150	2,590

The type of frame used in rate-of-growth trials at the Marton Experimental Area. Most frames are of this type.

Seasonal Production

Table 2 shows mean production in each season on the different trials.

TABLE 2—MEAN DRY MATTER PRODUCTION (lb. per acre) IN DIFFERENT SEASONS

Location	Winter	Spring	Summer	Autumn
Dargaville ..	2,200	5,000	5,020	3,350
Hamilton ..	1,460	4,270	2,410	1,840
Stratford ..	480	2,120	2,020	1,480
Hawera ..	1,290	2,760	2,560	1,570
Marton ..	1,190	4,190	2,860	1,860
Gisborne ..	2,320	4,070	3,130	2,730
Winchmore (dry) ..	180	1,780	1,750	410
Winchmore (irrigated) ..	200	2,360	3,660	820
Invermay ..	430	3,020	3,270	1,100
Winton ..	290	3,100	3,510	1,560

(Seasons are based on winter as June, July, and August.)

In winter there is great variability in production in different districts. Production at Dargaville and Gisborne is outstandingly high; Stratford winter production, on the other hand, more closely approaches South Island figures. Hamilton figures show easily the most variation from year to year.

Spring production is low at Stratford and Hawera. This is associated with a late commencement of spring growth and the absence of a marked flush of production in spring. The variation in spring growth from year to year in all districts is relatively small. Winton is an exception. Here the winter really extends into the months taken as spring. Though the time of commencement of spring growth is usually late, the spring flush is often most pronounced at Winton. At Dargaville, though the range of spring production is considerable, at its lowest level growth is greater than the mean of most other districts.

Dargaville shows much the highest summer production. This is partly associated with climate and partly with paspalum growth. It is noteworthy that irrigated pasture at Winchmore and non-irrigated pasture at Winton are next in order of summer production. Winton, in fact, has the highest summer production (6650lb. of dry matter per acre) recorded in Extension Division trials. Variability from year to year is high in all areas except Taranaki. At Marton, for instance, the lowest recorded production is less than one-fifth that of the highest; at Rukuhia it is less than one-third. The greatest variation is on dry land at Winchmore.

The type of frame used in the Dargaville rate-of-growth trial. This type is used only where cattle grazing in the surrounding field make the open-at-the-top type of frame unsuitable.

Dargaville and Gisborne have the highest mean autumn production and Winchmore the lowest. It would appear from other evidence that insufficient water has been applied at Winchmore to the irrigated part of the trial to secure maximum autumn production. It is expected that in future years this figure will be considerably exceeded. Variation from year to year in different districts is extreme—even greater than with summer production. This is usually due to the uncertainty of an autumn flush of growth; if dry weather continues until the colder weather, autumn production is very small.

In most cases the difference between a low and a high production year is more pronounced in summer and autumn. This is the period of greatest variation and, in dairy pastures at least, may at times be more critical than winter. In good years growth is greatest in November-December or November - January. It increases rapidly to this level during September and October and falls away more gradually toward May. Lower production years usually have a summer or autumn slump in growth which may or may not be followed by an autumn flush before winter.

Guide for Users of Chemical Weedkillers

NO aspect of agriculture has shown greater advances in recent years than the chemical control of weeds. However, because of the complexity of materials available and of the techniques in their use close study is needed if best or even satisfactory results are to be obtained in the treatment of specific weed problems.

Unless the farmer knows what materials to apply, how and when to apply them, and what risks there may be, a considerable amount of money can be wasted and worse still damage to pastures can result. The position is becoming more complicated because new materials are being developed and are becoming available continually. However, the weedkillers have given the farmer great scope for improving production from his land and have provided a means for tackling land-development problems that have revolutionised this work.

An invaluable guide to farmers in the selection of the correct materials and methods for controlling weeds is Bulletin No. 329 "Chemical Methods of Weed Control", which has just been published by the Department of Agriculture. This bulletin describes chemical weedkillers and their properties, gives an extensive list of weeds and their control, discusses the control of weeds in specific areas, and sets out the most important weeds in New Zealand and problems in their control. The bulletin is available free from offices of the Department of Agriculture.

Pedigree Pig Breeders' Progressive Scheme

FOR a number of years the Official Pedigree Sow Recording Scheme operated by the Department of Agriculture for pig breeders has been little used because breeders found that farmers who bought stock from them paid little or no heed to the information available through these records. However, breeders realise that they cannot relax their efforts if they are to continue the improvement of productive and carcass qualities of their stock. They have, therefore, shown their good faith in the promotion of purebred pigs by giving their support to a new scheme of on-farm recording of their litters which should assist them in their selection of breeding animals. This article by A. Longwill, Superintendent, Pig Industry, Department of Agriculture, Wellington, outlines the scheme and discusses its significance in relation to the work of pig improvement in New Zealand.

THE economic qualities of pigs for which it is possible to exercise selection in breeding may be briefly defined as:—

(a) Prolificacy and mothering and milking ability of the sow.

(b) Feed conversion efficiency of progeny.

(c) Carcass quality of progeny.

Methods of recording these aspects of performance have been worked out and put into operation with varying degrees of effectiveness in all countries in which the pig industry is of any importance. Denmark has pioneered much of the development in progeny-testing methods and has achieved really outstanding results by proper application of the underlying scientific principles.

It has been established that effective selection for those factors which are readily influenced by environment and management can be carried beyond an elementary stage only if the progeny test is carried out under conditions which are as nearly as practicable identical for each test group. Recent refinements of technique have now given a high degree of uniformity in the test conditions to which the pigs are subjected. Individual feeding eliminates the necessity to use average figures for food consumption, and a number of other practical difficulties which are apt to arise under group feeding. This is the ultimate objective which must be kept in view in progeny testing, but the establishment of the necessary facilities would be very expensive. Some preliminary work can be carried out without much expense by breeders selecting under the conditions prevailing on their own farms.

Basis of New Scheme

The new scheme, which was started on 1 June 1956, is designed to provide breeders with the means of making a preliminary selection among their breeding stock on the basis of the performance of their progeny under their own farm conditions. The ability of the sow will be measured by one litter weighing at 3 weeks of age. If the litter reaches a standard laid down as a minimum for qualification in this respect, the breeder may send in two or more pigs from the litter for carcass test, either as porker or baconer carcasses.

The minimum standard of litter performance at 3 weeks (21 days) to qualify for complete recording and publication of records is as follows:—

	No. of piglets	Total litter weight
		lb.
Maiden litter	7	75
Second and subsequent litters	8	95

HEADING PHOTOGRAPH: The inherent capacity of the sow as a mother and milker is best judged on the number of piglets in the litter and the weight of the litter at 3 weeks.

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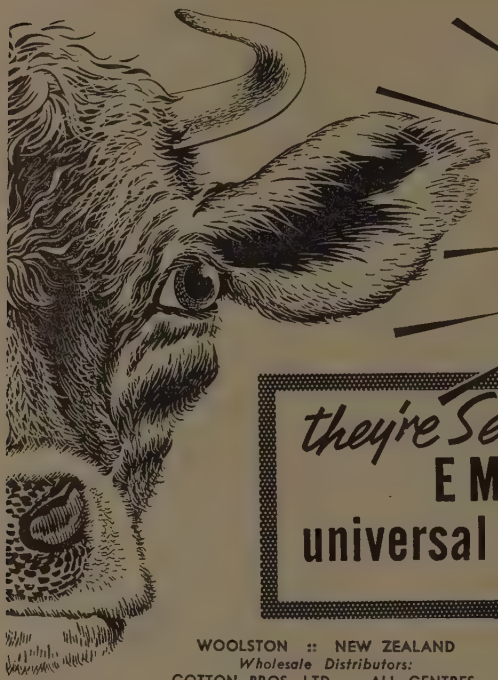
The breeder must supply reasonable facilities for catching and weighing the pigs. These do not need to be elaborate, but as it will be desirable to check liveweights when test pigs are nearing the time of dispatch to the works, the installing of a suitable weighing crate in drafting yards designed to make the handling of pigs easy would generally be worth while.

When the litter has reached market weight the breeder will notify the Livestock Instructor responsible for recording the litter of the date on which the test pigs are to be dispatched to the works. The Livestock Instructor will call and tattoo the test pigs from the litter, completing cards of notification to the works and forwarding the cards so that they reach the works ahead of the pigs, thus enabling the pigs to be identified with certainty. Points will be allocated for growth-rate and carcass quality and if these reach a standard of 70 per cent. of possible points, the results will be published.

The records published in this form will have the weakness common to all records of performance achieved under farm conditions that they will not be strictly comparable. Ability to interpret the records achieved under the conditions on a particular farm will play a big part in the use which can be made of these records. However, as breeders know the farms from which they purchase and have a fairly accurate idea of the standard of feeding and general management, the records should be capable of reasonably accurate interpretation for the purposes required. Further, since growth-rate is coupled with carcass quality, satisfactory all-round performance will not be obtained if either of these is substandard.

Operation of Scheme

The Department of Agriculture, through the Superintendent, Pig Industry, will operate the scheme. Livestock Instructors will continue to carry out litter recording on farms. Nomination forms are available in all offices of the Department, district pig councils, and branches of the New Zealand Pig Breeders' Association. These must be forwarded with the breeder's fee (£1) to the secretary of the New Zealand Pig Breeders' Association to arrive there not less than a fortnight before the litter is due. After checking the details of breeding and identification of the parents of the litter the Pig Breeders' Association



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office will forward the nomination to the Department of Agriculture, Wellington, from where instructions will go to the appropriate field officer to carry out the recording.

The fees, with a subsidy of 10s. per litter, will be paid by the Pig Breeders' Association to the Department in a lump sum annually covering the number of litters recorded during the year. Further, the New Zealand Pig Producers' Council is contributing 15s. per litter, up to a maximum of £500 in the first year, so that the industry itself is finding a much greater proportion of the cost of recording pedigree litters then it has done hitherto.

Significance of Scheme in Breed Improvement

From what has been said already it will be realised that on-farm litter recording must be regarded as the "coarse screen" through which the numerous lines of pedigree pigs must pass before coming to the stage of improvement where finer screens and more precise methods are brought into play to help breeders in their efforts to attain a high degree of efficiency and uniformity in their pigs.

With careful interpretation and use of the records obtained it will certainly be possible for the breeder to make more accurate selection within his own herd. Only in big herds using a number of boars will this mean a substantial improvement in the efficiency of selection. Livestock improvement by breeding depends very largely on the ability to pick the superior sire. The small breeder who depends on an outside source for the supply of a new sire needs the testing-station type of progeny test to help him to make an accurate comparison between two or more boars. The same, of course, applies to the larger breeder when he needs to go outside his own herd for a new sire.

However, selection on the basis of on-farm recording results will mean that provided the standard set is reasonably high, the animal selected should have, at least in some measure, the superior hereditary characteristics sought by the breeder. However, it will not be possible to be sure that some good hereditary material is not lost through the failure of the test litter to reach reasonable performance standards because of indifferent management.

This leads up to the question of the provision under the new scheme of a reasonably uniform standard of management on all the testing breeders' farms, with a minimum which would enable good pigs to perform satisfactorily. On what basis is it possible to assess this standard?

Standard of Management

Feeding guides have been drafted to cover the whole of the independent feeding life of the pigs of the litter. Feeding management is the factor which will have the greatest influence on the progress of the litter during the test period. Housing and the degree of control over the pigs while under test obviously will have some effect, though it is well known that provided feeding and other aspects of management are consistently good, elaborate or expensive housing is not necessary.

There will be opportunities for valuable discussion on feeding and other aspects of management, and the Livestock Instructors who are doing the recording will have both opportunity and responsibility for promoting the extension of improved practices.

However, breeders are not likely to follow feeding guides very precisely, if only for the reason that the quality of the rations fed and the proportion and type of meal supplements will vary. Because of these limitations of any system of on-farm recording the most satisfactory criterion on which any assessment of carcass quality results can be made is that growth-rate must be up to a reasonable standard.

Growth-rate itself is not simple or easy to define, as, expressed in terms of pounds gain per day, the standard must vary according to the weight of the pig at slaughter. The standard to be employed will be on the basis of a growth curve plotted from the actual growth results of large numbers of pigs on feed trials. Full growth-rate points will be awarded to all pigs growing up to, or faster than, the standard shown. Unless growth is such as to score 70 per cent. of possible points, the carcass results have very little validity and therefore will not be published.

Benefits to Commercial Pig Raiser

Breeders cannot be expected to maintain enthusiasm for a system of testing which involves them in considerable extra effort and expense unless they can see that it pays them. If half the animals tested achieve a standard which warrants official commendation under the scheme, it will have cost the breeder on average £2 per litter. This cost together with a return for the extra work involved and an incentive margin to make the

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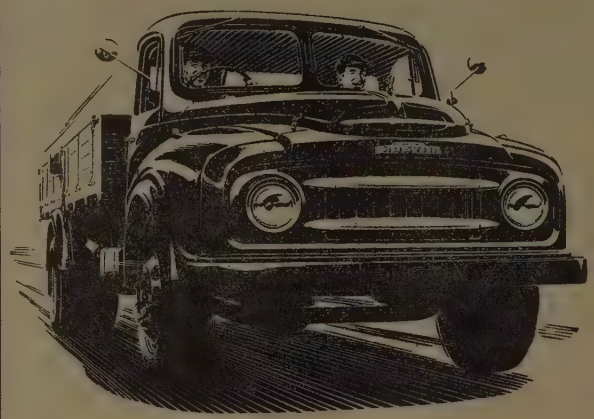

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breeder feel that it is all worth while must be covered. This means that £4 to £5 per litter above the value of untested stock would be a reasonable expectation for the testing breeder to maintain interest in the scheme.

Is it worth while for the commercial pig raiser who breeds his own pigs to pay, say, £1 per head (the average number of pigs sold for breeding per litter would certainly not be more than 4 or 5) more for breeding stock proved under the new scheme than for untested stock?

Though it would be impossible to prove this in any particular case, it is safe to say that on the whole the chances of the stock being better than average in farm performance and carcass quality are sufficiently good to make tested stock at £1 per head extra a very good investment.

In these days, when a short-supplied market results in small, if any, differentials for quality in carcasses it has become fashionable to question the value of any efforts to improve carcass quality. However, every producer who takes the long view knows that under stable market conditions quality will always command a premium, and even today those who set themselves out to produce carcasses of consistently high quality can make special arrangements for the sale of quality stock at a premium.

It is not premiums for quality alone that determine the profitability of the breeding stock, however. The more efficient breeding and fattening strains and individuals can have an even bigger influence on profits by securing more of these premiums at lower cost in feed consumption, labour, and piggery overhead.

There is a tendency under the system of pig raising typical of the dairy farms of this country to place little or no value on the dairy by-product which is fed to the pigs. The fallacy of this outlook is never more convincingly demonstrated than by the difference between the best and the worst litters in any herd. If every litter were as good as the best, very much more pig meat could be produced from the same milk or whey supply.

Relationship to Hybrid Sow Scheme

The hybrid sow scheme (sponsored by the New Zealand Pig Producers' Council in conjunction with the Department of Agriculture), which aims at the production of first-cross sows from progeny-tested purebred parents, is beginning to have some effect in providing efficient sows for the commercial pig raiser.

If the present scale of operations could be intensified, the advantage of having more efficient breeding stock could be spread to more of those farmers capable of exploiting the greater productivity of these animals. However, crossing alone is not a guarantee of superior performance. The purebred animals must themselves be selected on their productive ability as purebreds and also their suitability for "nicking" in crossbreeding.

The on-farm testing of pedigree strains will therefore facilitate selection of the purebred animals, which may be classified into two groups:—

1. Elite: Tested for productive ability both in pure and crossbreeding and used for continued stud breeding.
2. Animals of superior productive capacity which on test for crossing ability may be used in the production of breeding sows under the hybrid sow scheme.

Aims

The pedigree pig improvement scheme is a joint effort on the part of the industry and the Department to place the selection and management of pedigree breeding stock on a surer basis of efficient productivity. The co-operation of the trade is also assured, as improvement of quality in the carcasses produced is an important feature of the scheme. Co-operation by all the interested parties in this way is the best guarantee of sound development in the industry.

☆

Radio Broadcasts to Farmers

RADIO broadcasts to farmers will be given during August as follows:—

1XH Hamilton, 12.33 p.m.

13 August—"Mothering of Lambs", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

20 August—"Incidence of Feed Flavours in 1955-56", by G. Purvis, Superintendent of Butter Instruction, Department of Agriculture, Hamilton.

27 August—"Facial Eczema from a Farmer's Viewpoint", by M. Hewitt, Federated Farmers, Hamilton.

1YZ Rotorua, 7.15 p.m.

2 August—Young Farmers' Clubs talk.

16 August—Seasonal work for beekeepers, talk by Apiary Instructor, Department of Agriculture, Tauranga.

30 August—"Seasonal Troubles on the Sheep Farm", by K. G. B. Wilson, Livestock Instructor, Department of Agriculture, Opotiki.

2YZ Napier, 7.10 p.m.

14 August—"Feed Flavours in Hawke's Bay", by L. W. Scott, Farm Dairy Instructor, Department of Agriculture, Hastings.

28 August—"Spring Management of Bees", by L. J. S. Line, Apiary Instructor, Department of Agriculture, Hastings.

2XA Wanganui, 8 p.m.

2 August—"For the Countrywoman", by Mary Macdonald.

9 August—"The Radio Vet.", by S. Jamieson, Veterinarian, Department of Agriculture, Wanganui.

16 August—"Hydatids", by J. F. Munting, Livestock Instructor, Department of Agriculture, Wanganui.

23 August—"Wheat Growing in Rangitikei", by A. K. Booth, Instructor in Agriculture, Department of Agriculture, Wanganui.

30 August—"Main Shearing", by J. G. Ball, Sheep and Wool Instructor, Department of Agriculture, Wanganui.

3YA Christchurch, 12.20 p.m.

6 August—"Selection for Wool", by I. S. Miller, Sheep and Wool Instructor, Department of Agriculture, Christchurch.

20 August—Review of "The New Zealand Journal of Agriculture", by E. G. Smith, Instructor in Agriculture, Department of Agriculture, Rangiora.

4YA Dunedin, 12.30 p.m.

7 August—"The Use of Hormones for Increasing the Size of Apricots", by D. W. Wilson, Horticultural Instructor, Department of Agriculture, Roxburgh.

14 August—"Early Weaning of Lambs in the Maniototo", by W. A. Lunn, Fields Instructor, Department of Agriculture, Dunedin, and C. E. Broad, Livestock Instructor, Department of Agriculture, Ranfurly.

21 August—"Lucerne Grass Mixtures", by N. A. Cullen, Invermay Research Station, Mosgiel.

28 August—"Transport of Livestock", by J. P. Shennan, Assistant to Livestock Superintendent, Department of Agriculture, Dunedin.

Regular Broadcasts

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8.5 p.m., Wednesdays at 8.1 p.m. (Northland stock market report), Fridays at 8.1 p.m.

1YA Auckland, Mondays at 12.33 p.m., Tuesdays, Wednesdays, Thursdays, Fridays, 7.45 p.m., and Saturdays at 6 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month), Thursdays at 12.33 p.m. and 7.15 p.m. (fortnightly).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m. Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawke's Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawke's Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

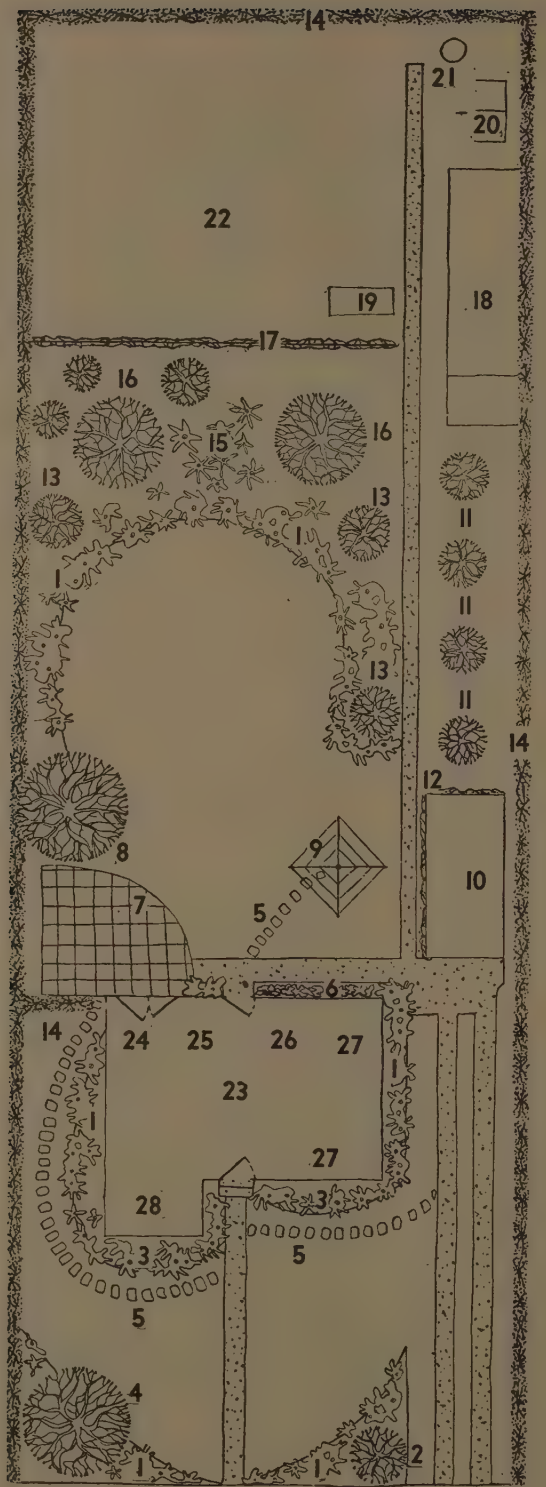
3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Mondays and Thursdays at 12.33 p.m.

4YA Dunedin, Tuesdays at 12.33 p.m., Wednesdays at 7 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.



Garden Planning

LITTLE imagination is shown by many home owners in the treatment of their gardens and many of the possibilities afforded by most sections are neglected. The result is street after street of stereotyped gardens each levelled off to a monotonous uniformity. This is often due to a lack of knowledge of elementary gardening and the ability to translate ideas into practice. This article, which is the second of three on the subject by J. S. Say, Horticulturist, Department of Agriculture, Auckland, indicates some of the ways in which a garden with character and individuality can be developed. The notes for routine garden work for August are by Elspeth Gray, Horticultural Instructor, Department of Agriculture, Auckland.

ANY section can be transformed into an attractive garden provided its limitations are accepted and development is directed along the lines dictated by size, shape, contour, etc. These may to a very large extent over-ride the personal tastes of the owner. For example, no matter how much a rose garden is wanted it is better to forgo it on a rocky section with a thin, light soil, for it would probably never be a success unless a great deal of time, work, and money was spent. Many plants are adapted to these hard conditions and would be far more suitable.

After all the factors mentioned in the previous article in the June issue of the "Journal" are considered ideas on how the garden is to be developed should begin to crystallise. It should be known in very broad terms what is to be grown, for example, if a vegetable garden is needed or if fruit trees are wanted. A decision about an outdoor living area, a play area for children, or a fowl house should have been reached. It should also be possible to have a good idea how the natural features of the section such as slopes, banks, and trees can be incorporated into the design or, better, how the garden can be planned around them. The need for shelter should also be decided. The common practice of getting a bulldozer to level everything before it should not be followed, for it is only in exceptional circumstances that heavy machinery is needed in the formation of a small home garden.

Necessity for a Plan

A scale plan of the section showing all the existing features will be of great assistance. The first decision to be made is where to put the house if it is not already built. Once this is settled the garden plan can be attempted. Drawing a plan may seem rather a waste of time, but disappointing mistakes can often be avoided if it is done. It is also much quicker, easier, and cheaper to make alterations on paper.

If development is to be spread over several years, a good basic plan will be appreciated more. It should be remembered that a garden is a living thing and that as work proceeds modifications may become necessary. A good plan, while allowing these alterations in detail, will make it possible to develop the garden along systematic lines so that when finished it will appear as a unit and not as a series of disconnected features.

← The first plan showing how a ¼-acre section with a 60ft. frontage can be developed along informal lines to combine utility and attractiveness. 1—Mixed flower border. 2—Upright deciduous tree 10ft. to 12ft. high. 3—Shade-loving shrubs or perennials. 4—Compact evergreen tree. 5—Stepping stone path. 6—Herb bed. 7—Paved outdoor living area. 8—Tall, spreading deciduous tree. 9—Clothes line. 10—Garage and tools. 11—Dwarf apples. 12—Fruit tree on trellis. 13—Large evergreen flowering shrub. 14—Hedge. 15—Ornamental shrubs. 16—Fruit trees. 17—Grapes, Chinese gooseberries, or climbing roses. 18—Fowl house. 19—Garden frame. 20—Compost. 21—Incinerator. 22—Vegetables. 23—House. 24—Dining room. 25—Kitchen. 26—Laundry. 27—Bedrooms. 28—Lounge.

Parts of a Garden

As a rule a garden may be divided into several fairly well-defined areas. Some gardens may have them all; others only two or three.

(a) The semi-public approach area between street and house.

(b) A more private ornamental area.

(c) An outdoor living area which is usually a special part of (b).

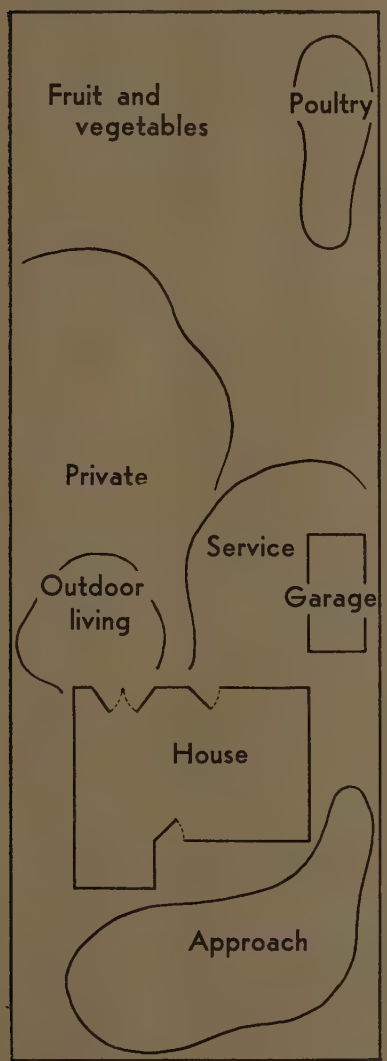
(d) A service area for clothes lines, play area, garage, workshop, and tool and wood sheds.

(e) A utility area for fruit and vegetables, compost, "hobby" plants, flowers for cutting, glasshouse, frames, poultry, and pets.

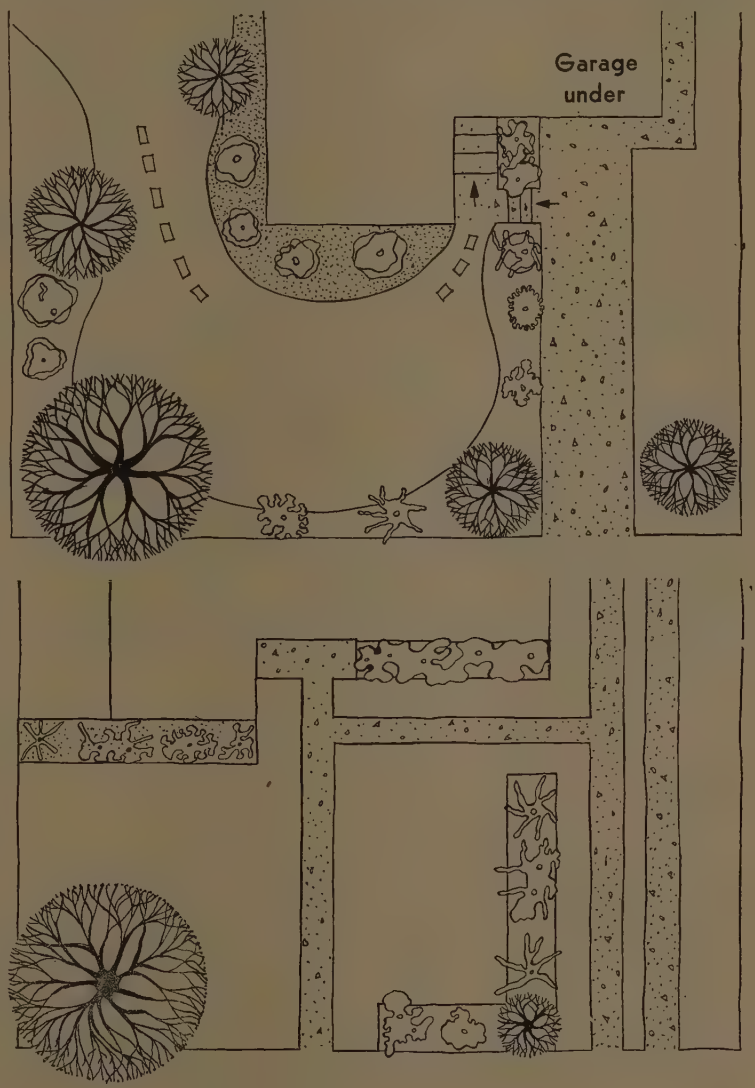
The plan should be marked out first to show roughly the areas to be allotted to the various purposes (see left below). After this a more detailed plan should be attempted. It should show in very broad outlines the way in which the areas are to be developed, for it is not necessary to know at this stage exactly what plants are needed. It is sufficient to get an impression of the general effect.

To do this it is a good idea to stand at various points on the section and at the principal windows and try to imagine a mature garden. The views from the kitchen, dining room, and lounge windows are most important. It is a great mistake to block out distant views if they are pleasant, but that is frequently done unintentionally by planting trees in the wrong places. It is essential to know the average mature height and spread of all trees planted. With care it is often possible to enhance distant views by planting to the sides of the main line of sight so that the picture is framed.

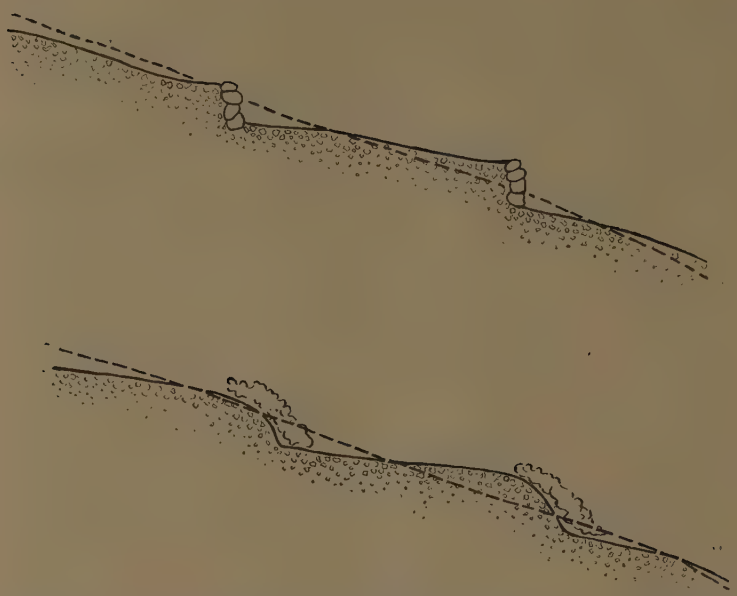
Where there are no distant views it is the aim of good planning to



The section marked out roughly according to the purposes to which the various areas will be put.



Two ways in which small front gardens can be developed, showing informal and formal treatments. The unbroken stretches of lawn have the effect of making the areas appear larger. Stepping stones are used to save wear on the lawn, especially in restricted areas.



Upper—Several low retaining walls are better than a single high one on sloping sections, as they are easier to build and lend themselves to suitable planting. Lower—Another way of dealing with slopes. Banks covered with prostrate shrubs are used in place of retaining walls.

create an impression of space within the limited boundaries of the section. Even on a small section this is possible by screening off adjoining houses as much as possible and by having an open area of lawn stretching away from the point from which the garden is usually viewed. If some interesting feature such as a good specimen tree or a pool can be introduced toward the end of this stretch of lawn, the eye is naturally drawn to this point and away from the foreground. A bank of trees or shrubs behind this will cut off the adjoining houses.

With sections that slope down from the point of viewing it is not so difficult to create an impression of space, for the view is not usually limited to the boundaries of the section. The most difficult problem is on sections which slope steeply upward and as a rule little can be done except to avoid accentuating the height by planting tall plants at the top.

Colour can be used to some extent to create an impression of distance. Strong colours should be limited to the foreground, with trees and shrubs with blue or grey foliage in the distance.

When the section is being viewed from the various points it is as well to ask questions such as these:—

Will a fully grown tree look right in that position? Should it be upright or spreading, evergreen or deciduous, and will it cast shade in the right place or block the view? What effect will it have on the neighbours and will it touch the telephone lines in a few years' time?

A rose bed should look well there, but will it get enough sun?

Would a border of shade-loving shrubs and perennials be more suitable?

Developing the Plan

At the stage of developing the plan pencil and paper become useful. Ideas should be roughly sketched in, it being remembered that a good garden should be a pleasant, friendly place, but must be convenient and workable. The design should be simple and practicable with each feature serving a specific purpose (see right-hand illustrations on page 87).

Paths and Drives

Paths and drives play a very large part in determining the convenience of the garden and the main access ways are usually the first items to be decided on. In general they should be as short and direct as possible to provide quick and easy access to the street and various parts of the garden from the house. This does not mean that all paths should be perfectly straight, for gentle curves can provide interest, but they should serve some definite purpose in the design. Sharp curves and angles should be avoided on level sections, but often become necessary on slopes to obtain a suitable grade. Paths which have to be used frequently and in all weathers must provide a dry footway which will not become slippery. Main paths should be wide enough for two people to walk abreast.

Steps are better avoided on main access ways if possible, but where they are necessary on steep sections the ratio between width of tread and height of riser should be considered to avoid steps that are awkward to use. In general 13in. treads and 6in. risers will be found satisfactory. A hand rail should always be provided on steep paths and flights of steps.

A minimum width of 7ft. is necessary for straight or gently curving drives, but this will have to be increased on sharp curves to allow room for a car's front wheels to swing out when turning. A very good indication of the correct curve and the width needed for a drive can be gained by running the car into the garage and backing it out over freshly raked soil. Satisfactory measurements for a straight drive of two concrete strips with grass between are 2ft. 6in. for the strips and 2ft. for the grass.

The actual positions of the main paths and drives should be considered with the layout of the garden in mind, but generally it will be found that the positions of the doors do not leave a great deal of latitude. (An article on paths, drives, and steps appeared in the October 1955 issue of the "Journal".)

Approach Area

The approach area is generally rather small unless the house has been sited well back on the section. As a rule, too, it is open to the public gaze, but with suitable planting or with fences it can be made completely private if privacy is desired. (Hedges and shrub borders will be discussed in a later article.)

Level Sections

On level or near-level sections the front is usually best treated as a semi-public area and developed as an open lawn with the planting confined to the perimeter and perhaps a specimen tree or two if there is room. To get the best effect and to make the space appear as large as possible several bad faults should be avoided. Beds cut into the lawn make it appear smaller and add to the amount of upkeep. Trees and shrubs dotted about the lawn give it a crowded appearance and make mowing difficult. Large trees should not be planted unless there is room for them to develop and it is always better to place them toward the sides rather than in the centre of the lawn. Phoenix palms have very extensive root systems and should never be planted in the small home garden for this reason, and also the spines at the bases of the leaves are very dangerous.

Upright cypresses are far too frequently planted without any regard to

their suitability. In some gardens and with some houses they can look attractive if their position is selected with care. In general they are not suitable as specimen trees on the front lawn, especially if they are poor forms which have to be bound up with wire to keep them in a reasonably columnar shape.

Standard roses, too, are often badly placed in the front garden and a little more thought could be given to their position. Frequently they are lined up in a narrow bed on each side of the path to the front door. In such a position they look out of place and do not show to the best advantage. They can also frequently become a hazard when the tops spread across the path. However, they can often be used effectively in the front garden to give height to a flat area. In this case the beds should not be less than 3ft. wide and they should be set back several feet from the path. A grass strip in front will greatly enhance the appearance of the bed. The roses can be underplanted with suitable low-growing annuals and perennials to provide colour, though not when the roses are at their best, as very strong colours in the low-growing plants then will detract from the beauty of the roses.

Sloping Sections

On sloping sections the problem becomes more difficult and very rarely is it solved by completely levelling the area. Apart from the cost and labour entailed, levelling raises other difficulties which often cannot be overcome satisfactorily. Banks which may be difficult to stabilise are formed and where they are of solid clay it is not easy to clothe them, especially if they face south. Unless special precautions are taken, the topsoil may be lost and a level area of infertile subsoil may result.

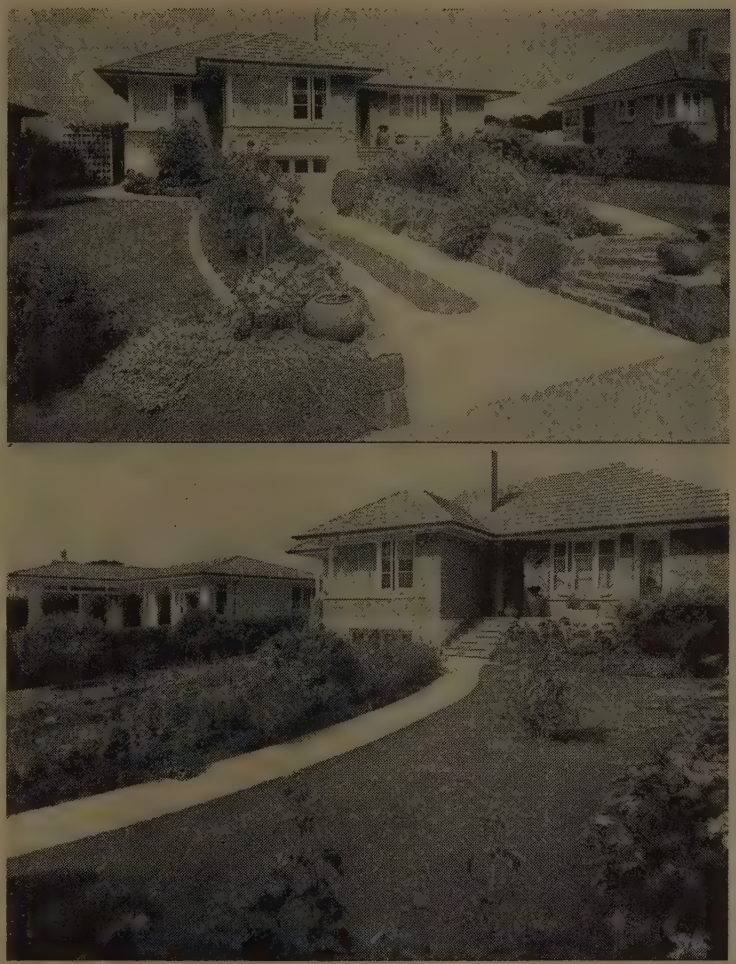
Retaining walls usually become necessary on steeply sloping sections, but as they are costly (unless the stone is available on the section) and not easy for the amateur to build, they should be reduced to a minimum. It is better to have a series of fairly low walls to bring the slope down gradually than to have high walls at the top and bottom (see illustrations on page 88).

Another way in which slopes can be treated provided they are not too steep is to use low banks in place of walls. These can easily be covered and stabilised with prostrate shrubs and can be made to look very attractive.

Where a series of banks or walls is used in this fashion it is better not to have them straight and regularly placed, as they are inclined to look like a giant staircase. Gentle curves can take away this appearance of formality.

Steep Sections

Very steep sections on which the amount of terracing needed would make this method impracticable are best left as they are and planted up with a solid mass of shrubs of varying height. A more or less natural garden of this kind can be made very interesting by using coloured and variegated foliage, autumn foliage, and plants that flower at various times of the year. Apart from differences in height and colours, interest can be added by using differences in growth habit and in the sizes, shapes, and textures of the leaves. Many plants are available which can be grown with a little care on steep sections even though they are poor or rocky.



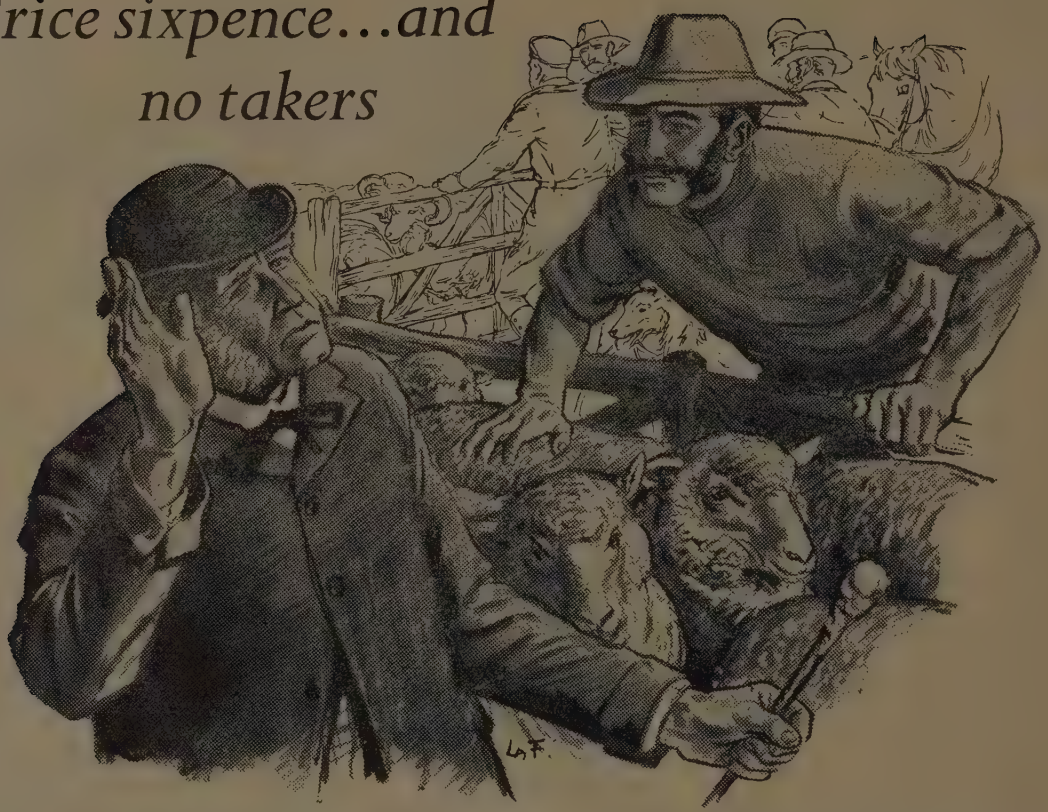
[*Sparrow*

Two views of a well-kept and simply laid out garden on a small section. The severe effect of the straight drive is offset by the gently curved paths and the plants trailing over the walls. A careful blending of standard roses (on left of drive), dwarf shrubs, herbaceous perennials, bulbs, and annuals provides interest throughout the year. The creeper-covered trellis shade house screens the back garden from the street and provides a suitable home for hardy pot plants. Citrus and a feijoa are used as ornamentals on the extreme left.

Private Ornamental Area

Where possible a private ornamental area should be screened off from the street and developed along the lines suggested for the approach area. Frequently more space can be given to this area than is available on the street side and many more personal touches can be introduced. As it is the part of the garden to be enjoyed at leisure, it is best developed along informal lines. On more or less level sections an open sweep of lawn bounded by mixed flower borders will be found most satisfactory. A good specimen tree or shade tree should be introduced if possible.

Price sixpence...and no takers



In the 1870s, farming was in the doldrums and many a farmer could have been found trying to sell a sheep at sixpence a head. There was no market for New Zealand's enormous surplus stock.

In England, an exactly reverse situation existed. A fast-growing population had outstripped the country's home production resources and was crying out for food. And the shipping lines had a further problem; that of finding return freights for the ships which were bringing more and more migrants to New Zealand.

Not that there was any lack of produce in New Zealand. But England lay 100 days away—and what would become of meat and dairy produce after 14 weeks in an unrefrigerated hold?

It was quite obvious to the shipowners that the answer lay in solving the problem of refrigeration.

The experiments were many and varied. Then, on February 15, 1882, the Albion Line clipper "Dunedin" made New Zealand history. She sailed from Port Chalmers with 5,000 carcases of mutton as well as hares, rabbits, poultry and butter stored in a specially-designed freezing plant. She reached London in 98 days with the frozen cargo in excellent condition.

Four months later, the New Zealand Shipping Company clipper "Mataura" followed with 3,844 carcases of mutton, 24 quarters of beef and 77 pigs. She took 103 days on passage but again the cargo arrived in prime condition.

And there were no Freezing Works in those days where killing could take place. Slaughter had to be undertaken at the ship's side and the carcases frozen down on board. Nevertheless, the way was open.

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This is the part where special features can be introduced and imaginative use can be made of any peculiarities of the section. Slopes and undulations make an ideal base on which rock gardens can be constructed, for it is difficult to form a rock garden which looks natural on a level section. Hollows can be used to form a sunken garden or a pool and so save much work in excavation. A garden below the general level of the section can add interest and water can give a touch of life and movement. Pools should always be in a position where they receive full sun and should not be near deciduous trees.

Here, too, garden ornaments of good design such as a bird bath can be used as a focal point, but the use of tawdry and garish ornaments will only strike a discordant note completely out of harmony with any garden. The serviceable but prosaic concrete paths can be dispensed with here and something more ornamental used instead. Stepping stones are excellent in this part of the garden, for they are more or less inconspicuous yet will provide a dry footway across the lawn.

Difficult sections (for example, steep slopes or rocky areas) call for individual treatment which will tax the ingenuity of the owner. With thought they can be turned into very attractive gardens and if sections such as these are developed in accordance with the natural characteristics, a more satisfying garden will result, for it will have an entity which fits in with the general landscape. Though a level patch of lawn cut into a steep rocky section can look just as much out of place as a pile of rocks mas-

[*Sparrow*

▲ An unusual informal garden which is never dull. Shrubs and small trees have been selected for their flowers, berries, and autumn colour and are underplanted with suitable annuals, perennials, and bulbs. Cultivation is done from inconspicuous stepping stones.

▼ The back garden of the house shown in the two photographs on page 89 viewed from the corner by the shade house. Fruit trees screen off the vegetable garden, compost heap, and incinerator (left) and provide a shady spot for outdoor living. Sparrow photo.

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Five Diameters: ½″, ¾″, 1″, 1½″, 2″. **Two Grades:** Standard and Heavy-weight. **Six Lengths:** 100, 200, 300, 400, 500 and 600 feet.

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querading as a rock garden in the middle of a level lawn, it is always advisable to have a level area near the house if possible.

Outdoor Living Area

Before any extensive, and possibly expensive, plans are formed for the outdoor living area careful thought should be given to the amount of use it will have. If it is to be used for afternoon tea on a summer afternoon, a large shade tree on the lawn will suffice. If it is to be used for family meals during the greater part of the year, something more elaborate will be needed. To be entirely satisfactory several conditions should be complied with. It must be private and be handy to the kitchen or dining room. It should be protected from the wind, cool and shady in the summer, and if it is to be used in winter, warm and sunny. It should have a reasonably level surface to allow table and chairs to stand firmly.

The ideal is a paved area adjoining the kitchen and dining room with its own furniture sturdy enough to stand sun and showers. Summer shade can be provided by a carefully placed deciduous tree or a creeper-covered trellis.

The Service Area

If possible the service area should be screened off from the outdoor living area and the windows of the principal rooms. The clothes line should be within easy reach of the laundry by a serviceable path and should be in a position where it gets the sun and wind. A path to the garage, tool shed, etc., is also required. Easily damaged plants are better kept out of this part if it is used as a children's play area. If a portion of it can be paved, it can be used as a winter play area, for washing the car and doing many other odd jobs, and if nothing more suitable is available, as an outdoor living room.

Utility Area

To avoid any possibility of creating a nuisance fowl houses and compost bins are best kept as far from the house as possible, but they should not be near the boundary adjacent to a neighbour's house. They should be easily reached by a dry path and if possible out of sight. Full sun is necessary for glasshouse and frames. If fruit trees are to be grown, a great deal of space can be saved by growing dwarf apples and by using cordons, fans, and espaliers. Fruit trees need not necessarily be confined to the utility section, for many of them have great ornamental value. Citrus and persimmons in particular are well worth a place in the flower garden in warm districts, and in the south use can be made of apples and peaches, etc. Passion fruit, Chinese gooseberries, grapes, loganberries, etc., are excellent for covering fences or trellis used as screens. Guavas and feijoas can make good hedges.

[*Sparrow*

An effective way of dealing with steep rocky banks is by a solid planting of hardy shrubs and perennials.

The Final Plan in Detail

Plans can be very misleading, for there is always a tendency to cram too much in. After an apparently satisfactory plan has been evolved it should be roughly marked out on the ground with pegs and stakes. A length of hose is excellent for marking out the outline of curved beds, for it can be pushed into various shapes and will hold them even in the strongest wind. This will give a very good idea of how much space can be allowed for each tree or shrub and the exact size and shape of the flower beds and borders. For shrub and mixed flower borders sectional plans on a larger scale may be necessary to show planting details. These will also be very useful in keeping a record of the positions of bulbs and herbaceous perennials during the dormant season.

With a knowledge of the space available and the type of plant required a decision can be made about the exact species to be planted. The rough plan can then be amended to show the various plants which will be required. It will serve as a permanent record of the planting or, if development is to be carried out over a number of years, will be a reminder of what will be needed later.

Garden Work in August

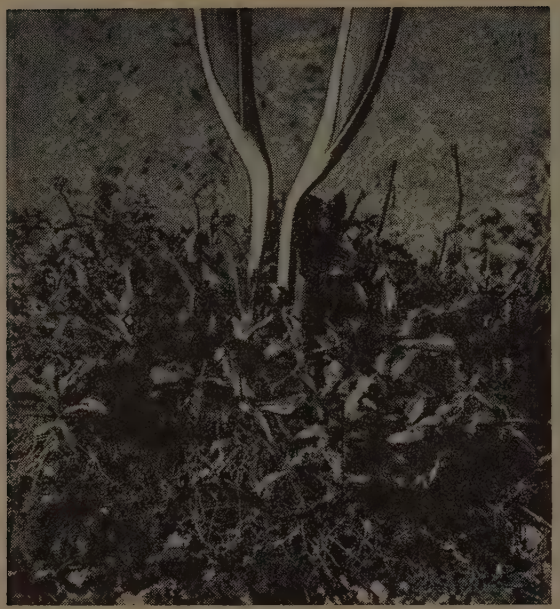
In most parts of the North Island August is the beginning of spring manifested by the reappearance of bulbs and blossom and the general start of most plants into growth. These are also the signs that the busy season for the gardener is once again under way and any work left over from July, such as the pruning of ornamental shrubs and roses, should be completed without delay. Early flowering shrubs should be pruned as soon as they have finished flowering, though in some cases enough will be done by picking the flowers for use indoors.

Further south, rose pruning should be done this month, extending into early September in the coldest areas. A 3:4:50 bordeaux mixture spray should be applied after pruning to combat any fungous disease spores which may be overwintering on the plants, and prunings should, where possible, be burnt and not left lying on the rose beds, where they provide a source of infection as soon as the weather warms up. If insect pests such as scale are present, a lime sulphur spray may be applied at a strength of 1 in 15 (1 quart of lime sulphur to 4 gallons of water) in place of the bordeaux mixture.

Chrysanthemum cuttings may still be taken early this month. Sturdy shoots that are situated well away from the base of the stem should be chosen. They should be about 2in. to 3in. long, the lower leaves removed and cut cleanly below a node with a sharp knife or secateurs. Plant the cuttings 1in. deep and 2in. apart in sandy soil either in a frame or in boxes or pots. If only a few are being taken, they may be planted straight into the garden provided that the soil is reasonably light and well drained and some protection can be given from heavy frosts.

Where perennials were not divided in autumn, including delphiniums which should be left until the new growth starts, this is the month to

GARDEN WORK IN AUGUST



[*Green and Hahn*

Dividing perennials by the use of two forks. They can be further divided by hand into pieces of a convenient size for planting.

divide them. Peonies can remain in the one place for up to 10 years without being disturbed, but the majority of perennials need to be lifted and divided at least every 3 or 4 years. Take the younger pieces from the outside of the clump for replanting, as the centre crowns are likely to be the original ones and therefore will not produce such healthy growth or good flowers. If the plants have started well into growth, it would be better to leave them undisturbed until autumn rather than risk giving them a severe check. The beds can be forked over lightly and a general fertiliser of 3 parts of blood and bone, 2 parts of superphosphate, and 1 part of sulphate of potash can be applied at 1oz. or 2oz. per square yard.

Gladiolus can be planted out now in the warmer districts for early flowering. By successional planting, flowers may be had over a long period, as the corms take approximately 90 days from planting to flowering. This time may be lessened where growing conditions are very good, and increased if the soil and weather are cold. They do best in a well-worked, free-draining soil not recently manured and, in the warmer areas on light soil especially, should be planted fairly deep to keep the corms as cool as possible. Early plantings usually remain fairly free from thrips, but for the later ones a spray of DDT at 1 teaspoon to 1 gallon of water every 10 days should be applied, starting when the leaves are 5in. high. Dusting the corms with DDT powder before planting may also be worth while. A depth of 6in. is satisfactory for planting in most cases, but may be increased in warm districts except in very heavy soils. If the flowers are wanted only for cutting, gladiolus soil should be prepared in the same way as described for autumn-sown lawns in the March 1956 issue of the "Journal". Lawns that were sown in autumn should not need much attention this month apart from mowing and rolling to consolidate them where hard frosts have been experienced. The first mowing of a new lawn should be done with the blades of the mower set fairly high and they should be gradually lowered as the grass becomes firmly established. The reason for this is that if the grass is cut too hard while it is still very young and the weather is cool, it will be retarded and take longer to establish satisfactorily and may even die out in patches.

New lawns can be sown this month, if they were not done in autumn, provided that the soil can be prepared satisfactorily. For a fine lawn the best mixture is 2 parts of chewings fescue and 1 part of browntop at ½oz. to 1½oz. to the square yard. The may be planted in a separate bed, for instance one end of the vegetable garden, but where they are wanted for display they may be planted in a herbaceous border or wherever else it is desired.

This month hardy annuals may be sown under glass or outdoors in covered seed-beds in the north. If possible, it is best to sow the seed in soil that is not likely to have many weed seeds in it; a good mixture is turfy loam, leafmould, and sand in the proportions of 2 : 2 : 1. To ensure that the seedlings have a good start mix 1½oz. of superphosphate and ¾oz. of lime with every bushel of soil. A 40lb. apple case holds approximately a bushel. Seeds that can be sown now include *Phlox drummondi*, aster, antirrhinum, lobelia, 10-week stock, salvia, petunia, ageratum, African and French marigolds, and verbena.

Now that the worst of winter is over a check on all new shrubs and trees recently planted would be in order. Ties that are too tight should be loosened and plants that may have worked loose must be firmed in to ensure that the roots become established. Many home gardens lack adequate shelter for a really good display, as nothing will grow well when it is being continually blown around and having its roots loosened.

It is not too late to plant shelter hedges, though unless the plants have been ordered or are being grown from seed, it is likely that stocks in the nurseries may be rather low. For coastal areas *Myoporum serratum* (Tasmanian ngaio) and *Coprosma baueri* (taupata) will withstand salt winds and grow quite readily. Inland, tree lucerne, *Buddleia salvifolia*, and *Albizzia lophantha* all give quick temporary shelter. The tree lucerne and albizzia can be sown from seed toward the end of August and in September. To get the best results the seed should be placed in boiling water and the water allowed to cool. This softens the hard seed coat and the seeds germinate more readily. They are then drilled into damp soil about 6in. apart. Albizzia is frost tender and is therefore used mainly in the warmer and coastal areas of the North Island. Both of these plants can be trimmed to make very satisfactory temporary shelter for a few years, but neither is satisfactory as a permanent hedge.

A permanent hedge takes some years before it becomes a feature of the garden, and the planting of it should not be haphazard. It is best to plant something that is known to do well in the district and which is suitable for the purpose. When a hedge is being planted the soil should be prepared as thoroughly as it would be done for a specimen tree or shrub.

Too often the hardiness of hedge plants is over-emphasised and they are planted out into soil that has had little or no preparation in the way of cultivation. They are just as responsive to good treatment as are other garden plants, and in exposed situations hedges must be encouraged to grow as quickly as possible to provide shelter for more delicate plants. *Escallonia* spp., *Abelia chinensis*, *Lonicera nitida*, and privet (*Ligustrum ovalifolium*) all make neat hedges that can be trimmed to any height desired.

In comparatively frost-free districts *Tecoma capensis* makes a very good hedge, though it needs the support of a fence if it is to be grown to more than 3ft. to 4ft. high. Large trees, for example *Cupressus macrocarpa* and *Chamaecyparis lawsoniana*, are excellent for farm shelter, but grow far too big for the average home garden.

Pot plants such as fuchsias and geraniums which have been grown throughout winter may be trimmed up (cut back to healthy wood) and repotted if necessary. Maidenhair ferns and similar plants can also be divided and repotted, though it is not necessary as frequently with these as with some pot plants.

Wallpapers and Paperhanging

By ELIZABETH LAURENSON,
formerly Field Officer in Rural Sociology, Department of Agriculture, Auckland

IN these days of "do it yourself" the householder is often prepared to do much of the redecoration of his own home. Many apparently formidable undertakings are found to be simple, especially if instructions are clear and are followed carefully. Paperhanging may be tried by the amateur and very good results may be obtained, so that walls take on an attractive, new appearance. Some of the wallpapers available and the art of paperhanging are discussed in this two-part article, the second part of which will appear in the next issue of the "Journal".

IN earliest times the first wall hangings used for decoration and to give some protection from draughts in caves and crude dwelling places were skins and fabrics made from grasses. Since then a great advance has been made to the colourful wallpapers used to decorate walls today. Tapestries, which were works of art recording historic events, were hung in the great halls of castles in medieval days and the Bayeux tapestries, worked in the late 11th and early 12th centuries, are still in existence. Painted cloths and decorated leathers were used as wall hangings and later there were silks, satins, and velvets.

Early Wallpapers

The first wallpapers were looked on as a cheap substitute for the costly tapestries, silks, and velvet hangings and embroideries which they often imitated. In the Tudor period black and white papers made by the trunk makers, upholsterers, and cabinet makers were popular. In the 17th century "flock" papers were produced. These were made to resemble the beautiful Italian brocades and velvets and were produced by craftsmen whose forefathers had been engaged in flocking cheap cloth to make it appear more expensive. The design was outlined on the paper with adhesive and then shearings of cloth were scattered over the paper and clung to the adhesive. Beautiful Chinese painted papers were imported into England in the 18th century; and craftsmen in the furnishing and decorating trades produced a variety of papers of great beauty. Then in the 19th century French papers which were perfect in detail were produced.

The first wallpaper printing machine was producing in 1840 and at the great exhibition in the Crystal Palace, London, in 1851 there was a huge range of machine-printed wallpapers. These papers were cheap so that most people could afford to buy them, but they were generally of poor design. However, in a few years the designs had improved.

Today wallpapers are very popular. Wallpaper is a practical form of decoration and there is an unlimited number of different designs and colours so that different effects can be produced. With the variety of papers available it is not difficult to choose a paper to suit individual requirements.

Selection of Wallpaper

The wallpaper selected for a room will depend on several factors. Some types of paper are more suitable for bedrooms and others are good for bathrooms and kitchens, where the atmosphere is steamy. The wallpaper chosen will also depend on whether the room is well or badly lit, and obviously a dark room will appear brighter if a light-coloured paper is chosen.

Very often it is unsatisfactory to choose wallpapers by studying pieces in a pattern book. The small piece does not show how the paper will look on the walls, so that it is difficult to visualise how the room will appear. In some shops showrooms are arranged so that the customer can see how the paper will look when hung. Another very good method of choosing from several rolls of wallpaper is to pin some lengths of paper on the wall of the room to be papered. If this is left for several days the lighting effect, pictures, upholstery, and furniture can all be seen against the background of the paper and the best selection can be made.

Types of Wallpapers

Most English wallpapers are sold in rolls 11½yds. long and 22in. wide. There is a margin or selvedge on both sides of the paper so that when the paper is trimmed it is 21in. wide. Exceptions are lining papers, which are 30in. or 22in. wide and 11½yds. long. As these are plain in colour, there is no waste from trimming. Other imported papers vary in width and length. Canadian papers are 14yds. long and 21in. wide.

Most papers today are machine printed, but there are still some of beautiful design and perfect workmanship that are hand printed. Wall hangings are classified according to quality, uses, method of printing, type of ground, surface, or colours. Paper forms the basis of most wall hangings

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and sometimes the paper is reinforced by other materials.

Pulps are the cheapest papers and they are coloured during manufacture so that the pattern can be printed on them without further preparation.

Grounds are papers which have no colour until the plain ground colour is applied to the surface before the application of the pattern. These papers are superior in colour and durability to the cheaper class of pulps. The grounds may be plain or they may be "satin" (when they are treated to look like satin), and some expensive papers are treated to look like rich silk brocades.

Many papers are embossed to give different effects such as imitation woven fabric or plaster. The pattern or background is stamped to give a low relief effect and the best qualities are reinforced with additional backing.

Flock papers are sometimes used to give a rich effect. The design is printed on the paper with adhesive and is then dusted with finely powdered wool or silk.

For kitchens and bathrooms papers called sanitaries are used. These are printed in oil colour instead of distemper and have a very smooth surface to avoid catching dust. The papers can be washed down when required. Varnished papers have the same object as sanitaries and the designs of both types of papers include marbles, tiles, and mottled effects which are suitable for bathrooms.

There are also on the market papers with a plastic finish. Some of these papers have the design only applied in plastic composition and others have an all-over plastic finish which gives the paper a rather shiny appearance.

Lining papers are plain papers which are sometimes used on a surface that needs improving before better papers are hung. Where a surface has been repaired lining paper may be used to make a smooth surface or to give some resistance against dampness.

Preparation of Wall Surfaces

Before wallpaper is hung it is essential that the wall surface be prepared carefully. The ideal surface for paperhanging is smooth, dry, clean, and slightly absorbent. Not all surfaces are satisfactory, but many which are unsuitable may be given treatment and made suitable. The correct and thorough treatment of the walls is very important.

Walls Previously Papered

All of the old paper must be removed from previously papered walls. This is done by thorough saturation with warm water to soak the paper and soften the paste. Several applications of water may be necessary, as both the paper and the old adhesive material must be soaked. Then remove the paper with a broad knife, taking care not to damage the wall with the knife. If there are several layers of paper, remove one at a time and do not try to strip all the papers off at once. After the paper is removed wash the surface well to remove any old paste. While the walls are still wet all holes and cracks should be raked out and then stopped with equal amounts of plaster of paris and whiting mixed together when dry and made into a paste with weak size. When the stopping has set and the surface is dry rub down the surface with abrasive paper and dust off and coat the walls with weak jellied size to give an absorbent surface.

A wall being stripped of old wallpaper. The wall at right has already been stripped and cracks and holes have been filled with plaster.

New Lime Plaster

Fill in all cracks and holes in new lime plaster walls with equal parts of plaster of paris and whiting mixed to working consistency with very weak size. Then rub down any rough places and protuberances with abrasive paper. Then dust off the walls and coat the surface with weak size.

Old Plastered Walls

Old plastered walls, when dry, are ideal for wallpaper if all imperfections and cracks are filled. Provided the surfaces have not been decorated, the only treatment required after cracks and holes have been filled in is a coating of weak size to make the surfaces absorbent.

Newly Plastered Walls

Do not paper newly plastered walls until they are thoroughly dried out. There may be efflorescence, which is a furry deposit of alkaline crystals. This can cause discoloration of the paper and any patches should be treated with a solution made from 1lb. of ferrous sulphate dissolved in 1 gallon of water. Strain and cool the solution and coat the walls with it.

Hard Cement Walls

Hard cement walls are usually unsatisfactory owing to their non-porous nature and the likelihood that moisture will condense on the cold surfaces. This may be counteracted by first coating the walls with size and then applying lining paper horizontally across them before the final paper is applied. The lining paper gives a smooth, absorbent surface to the walls and this is much more satisfactory for hanging the final paper.

Distempered Walls

Distemper on walls should be removed by washing the walls thoroughly until the plaster is as clean as if it were new and no more distemper can be removed. All the distemper must be removed, as any left will cause the wallpaper to leave the surface. A safe way to remove distemper is by scrubbing or washing the walls with a mixture of water and sugar soap.

Then stop any holes or cracks in the plaster with a mixture of plaster of paris, whiting, and weak size. Then rub down the surface with abrasive paper, dust it, and coat it with weak size.

Varnished Papers

Papers which have been printed in an oil medium or which have been

varnished after being hung must be removed completely. The following method may be used to remove these papers.

Prepare a stiff flour paste. Leave it to cool and add 1lb. of caustic soda to 1 gallon of paste. Brush the paste on the wall with an old brush, being very careful not to wet the woodwork, as the paste may damage any paintwork. Two or three applications of paste may be needed to soften the varnish and the paper beneath. Care must be taken that the paste does not touch the skin, as the caustic soda used may burn. Allow the paste to remain on the wall some time until the moisture has penetrated the varnish and softened the paste beneath. Remove the whole thickness with a stripping knife. When the surface is stripped clean wash down the walls with clean water and then with dilute vinegar to neutralise the caustic soda; rinse the walls with clean water.

Oil-painted or Varnished Surfaces

Oil-painted or varnished surfaces are unsatisfactory for papering, as they are not absorbent. The moisture from the paste may go through the paper, condensing outward. This can affect the adhesive qualities of the paste and also the colours of the wallpaper.

Matt the surface by wet rubbing it with coarse, waterproof glass paper, a pumice stone, or a wire brush. Next wash the walls with a weak solution of sugar soap or a 2 per cent. solution of waterglass. Rinse off the solution with water and then apply another coat of waterglass.

Stop any holes or cracks and then rub down the surface with abrasive paper and dust it. Coat the walls with weak size and hang lining paper horizontally, at right angles to the direction that the wallpaper will hang. This treatment of the wall gives a semi-porous surface and helps prevent condensation.

Tongued and Grooved Boarding

Tongued and grooved boarding is unsuitable for hanging wallpaper and must first be covered with scrim or thin canvas. Stretch the material tightly and secure it along the edges with tinned tacks. Do not paste scrim down. This allows the woodwork underneath to contract or expand but not to break the surface of the paper. Then size the scrim with a fairly strong size which is not too wet, as the size should be on the surface of the fabric and should not penetrate it.

Plaster-bonded Wallboard

Plaster-bonded wallboard will provide a very good surface for the application of wallpaper, provided the joints are well stopped or filled with plaster. Then rub down the surface with abrasive paper, dust it, and coat it with size.

Plaster

All cracks, crevices, or holes in a plaster wall should be filled or stopped with plaster. The mixture made from equal parts of plaster of paris and whiting mixed with weak size has the disadvantage that it sets very rapidly. This may mean that there is a certain amount of waste because the plaster sets before it can be used. There are on the market several brands of plaster filler which may be more satisfactory for use, as they set more slowly. When the surface is dry smooth it down with abrasive paper, dust it, and then coat it with size.

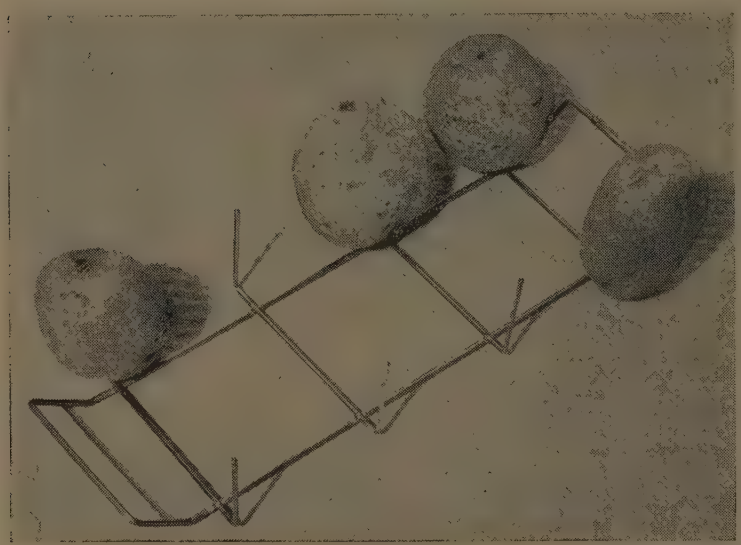
Size

Size should always be used. It is important to see that the walls are completely covered and that the size is dry before the wallpaper is applied.

Glue size may be used or there are several other brands of size on the market. Some of these proprietary brands have a preservative added to prevent formation of mould. An interesting new product is a cellulose adhesive which may be used as size and as paste.

Photographs by Sparrow.

A Rack for Baking Potatoes



[*Green and Hahn*

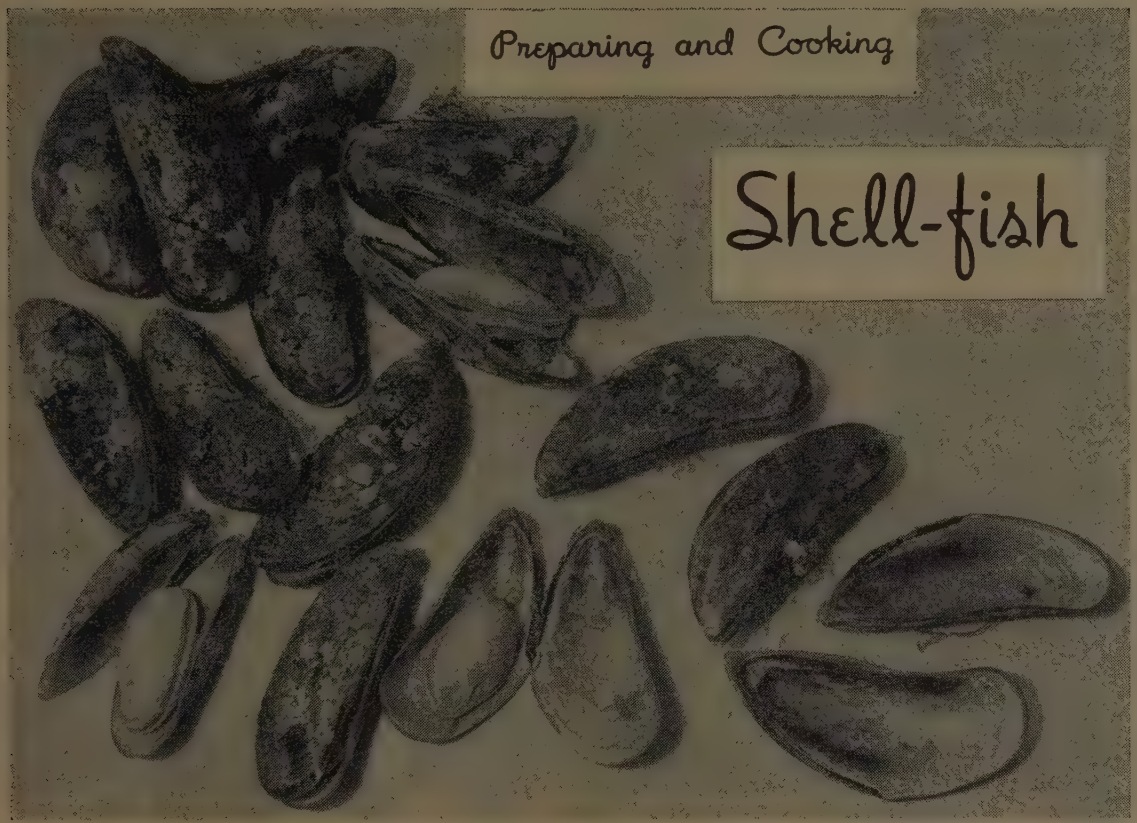
THIS rack for baking potatoes is a very useful addition to kitchen equipment. Potatoes can be placed on the prongs and the rack can be easily slipped in and out of the oven. It also lessens the risk of burning the hands when potatoes are being taken from the back of the oven. The heat of the metal prongs through the centres of the potatoes will make them cook a little more quickly.

The making of this rack will be a simple task for the farm handyman with a welding torch. Strong wire should be used to support the weight of the potatoes. In the rack illustrated No. 10 galvanised wire was used for the base and No. 12 wire for the prongs.

The base is made from a 36in. length of wire bent into shape and with the loose ends welded together. The ends of the base are bent up to be used as handles. Each pair of prongs is laid across the base and welded on separately, about 3¼in. apart to allow ample room for large potatoes. The ends of the prongs should be sharpened so that the potatoes can be pushed on easily.

If a larger rack is required, it is better to make two, as a longer rack than the one illustrated may not fit in the oven.

—*MARY HUNT,*
Field Officer in Rural Sociology, Department of Agriculture, Christchurch



Preparing and Cooking

Shell-fish

By ELIZABETH LAURENSON,
formerly Field Officer in Rural Sociology, Department of Agriculture, Auckland

MANY overseas visitors consider the toheroa New Zealand's finest delicacy. Toheroas may be collected on several beaches, and other shell-fish are readily available along many parts of the coast. A visit to the beach to collect shell-fish can often provide the reason for a day's outing and then the shell-fish can be cooked and eaten on the beach or taken home and cooked in a more elaborate manner. In this article the preparation of shell-fish and some ways of cooking them are described.

WHEN shell-fish are collected from the beaches freshness can be assured, provided they are not taken from polluted beaches, such as those near sewer outfalls. Only fresh shell-fish should be purchased. If mussels and oysters are bought in the shell, they should be alive. This is shown by tightly closed shells and if the shells are partly open, oysters or mussels must be discarded. Crayfish and prawns sold cooked should have been freshly boiled. The tail, if pulled back a little, should feel springy and not limp. If possible, it is best not to keep shell-fish for long before using them, as they deteriorate quickly, especially in summer, when they should be kept in a cool storage place.

Shell-fish are a good source of iodine and a fair source of vitamin B_1, but as they are not served frequently, they make little contribution to the diet. Shell-fish are often used in sauces or as a garnish to be served with boiled, fried, or steamed fish and there are many tasty dishes that can be prepared from them.

Mussels

Mussels may be collected from the rocks at beaches or bought prepared and ready for eating at fish shops. One of the most enjoyable ways of serving mussels is to boil them in sea water at the beach and eat them in the open.

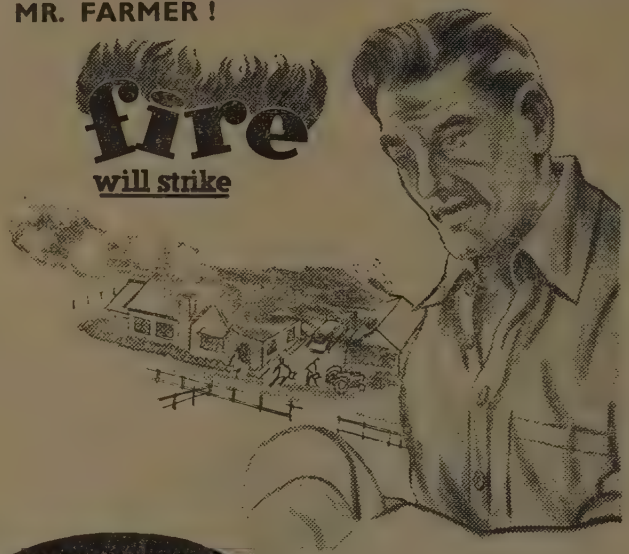
Mussels must be scrubbed and then rinsed thoroughly in running water to remove as much sand as possible. To cook mussels simmer them in a covered pan with a very little water. When the shells open the mussels are ready and can be removed from the shells. Cut off and discard the hairy beards and strain off and keep any liquor, which can be used for making sauces or to flavour fish soup.

Mussel Soup

24 mussels in the shell
3 cups of water
1 onion, sliced
2 or 3 pepper corns
1 bay leaf
1 tablespoon of chopped parsley
1 clove
2 tablespoons of butter
2 tablespoons of flour
1 cup of milk
Salt
Pepper

Wash the mussels in several waters, taking care to scrub off all the sand. Put the mussels in a saucepan with the water, onion, and seasonings. Simmer for 15 minutes, when the mussel shells should be open. Strain through fine muslin, keeping the stock. Remove the mussels from the shells and take off the beards. Melt the butter, add the flour, and gradually add the milk, stirring all the time. Cook for 5 minutes. Add the mussel

MR. FARMER !



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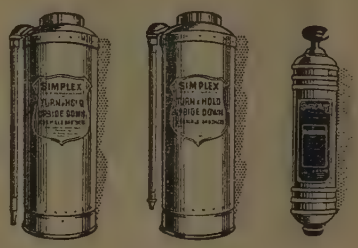

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stock gradually, season well, and when the mixture is boiling add the mussels and serve at once. Sprinkle with chopped parsley.

Scrambled Eggs with Mussels

30 prepared mussels
¾ teaspoon of salt
Pepper
1 tablespoon of butter
6 eggs, lightly beaten
1 tablespoon of cream
½ cup of soft breadcrumbs

(6 servings)

Chop the mussels finely and season with salt and pepper. Mix together eggs, cream, and breadcrumbs. Melt the butter in a frying pan, add the egg mixture, and cook over a low heat, stirring constantly until the mixture begins to thicken. Add the mussels and scramble slowly.

Mussels au Gratin

12 prepared mussels
½ cup of white wine
Finely chopped parsley
½ cup of water
1 cup of soft brown breadcrumbs
2 tablespoons of finely grated cheese

Place the mussels in a deep pan and add the water and the wine. Cover the pan, bring to the boil, and simmer for 1 minute. Remove the pan from the heat and allow to stand for 5 minutes. Drain off the liquor and set it aside. Arrange the mussels in a buttered fireproof dish and sprinkle them with breadcrumbs, then with parsley, and finally with cheese. Pour the strained liquor over the mussels, adding a little more wine if desired, and heat the mixture in a moderate oven (350 degrees F.) for 15 minutes before serving.

Oysters

Rock oysters or the larger, South Island oysters are available in the shops at certain times of the year. Usually oysters are sold already prepared for eating, but if they are obtained in the shell, they must be tightly closed. They can be opened by inserting a sharp knife between the shells on the valve side and cutting through. The oysters should then be washed and bearded and the liquor should be examined for any pieces of shell.

There are many delicious ways of using oysters, either as a main dish for the meal or as a savoury for parties.

Oyster Cocktail

12 oysters
1 teaspoon of tomato sauce
Salt
Pepper
2 teaspoons of lemon juice
1 teaspoon of Worcestershire sauce

Beard the oysters and put three in each glass with their liquor. Mix together lemon juice and the sauces and add salt and pepper. When well mixed divide the mixture between the glasses and serve.

Oysters on the Shell

Use the deep halves of the shells. Place a raw, cleaned oyster on each shell together with the liquor. Serve with lemon juice or vinegar, pepper, and thin brown bread and butter.

Pigs in Blankets

Dry one dozen large oysters and roll a half slice of bacon round each. Fasten them with tooth picks if necessary. Place them on a rack in a dish

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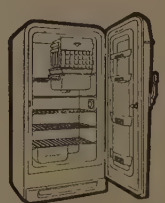

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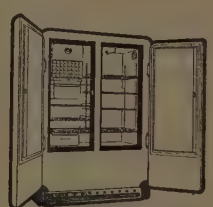

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and bake until the bacon is crisp. Serve hot.

Oyster Souffle

1 cup of chopped oysters	1 cup of milk
3 eggs	3 tablespoons of flour
3 tablespoons of butter	½ teaspoon of salt
	Pepper

Make a thick sauce by melting the butter, adding the flour, cooking it until it is smooth, and then adding the milk gradually, stirring to prevent lumps from forming. Cook the sauce until it is thick. Add the oysters to the white sauce, mix thoroughly, and cool slightly. Beat the egg yolks and add them. Beat the egg whites until they are stiff and fold them into the mixture. Pour the mixture into a greased baking dish, filling not more than two-thirds of it. Set the dish in a pan of hot water and bake the souffle at 350 degrees F. for 45 minutes to 1 hour. Serve immediately.

Fried Oysters

12 large oysters	Fine brown bread-crumbs
Salt	
1 egg (beaten)	Pepper

Dry the oysters in a cloth and roll them in the breadcrumbs seasoned with salt and pepper. Allow to stand for 15 minutes and then dip in beaten egg and again roll in crumbs. Allow to stand in a cool spot for another 15 minutes. Fry the oysters for 1 minute at 400 degrees F. Drain on paper. Serve hot garnished with parsley and slices of lemon.

Toheroas

Toheroas can be collected on some beaches at certain seasons of the year, but to conserve them the number which may be removed by each person is limited.

The toheroa has a three-sided shell. To open the toheroa slide a sharp knife between the shells on the long, flat side and the short, rounded side and cut through the muscles. Open the shell, remove the toheroa, and wash it thoroughly to remove the sand.

As toheroas are tougher than other commonly used shell-fish, they are most often made into stew or soup, though they can be minced and made into fritters.

Toheroa Fritters

6 toheroas	1 egg beaten in 1½ cups of milk
1 cup of flour	1 tablespoon of melted fat
1½ teaspoons of baking powder	1 teaspoon of salt

To make the batter sift the dry ingredients and add the egg, milk, and melted fat. Beat the ingredients only long enough to mix them; the batter should still be slightly lumpy.

Wash the toheroas, mince them, and add them to the batter. Drop dessertspoons of the fritter mixture into shallow fat and cook gently for 3 to 4 minutes on each side. Drain the fritters on absorbent paper and serve hot with parsley and lemon juice.

Toheroa Soup

12 toheroas	2oz. of butter
2 cups of water	Few grains of mace
2 cups of milk	Pepper
½ teaspoon of mustard	Salt
3 tablespoons of flour	1 teaspoon of lemon juice

(6 servings)

Wash and mince the toheroas. Simmer the minced toheroas in the

water for 1 hour and then rub them through a sieve. Melt the butter, add the flour, mustard, and mace and cook until the mixture froths. Add the milk gradually, stirring all the time until the mixture thickens. Cook for 3 minutes and then add the toheroa puree. Add the lemon juice, salt, and pepper and serve with croutons.

Scallops

Scallops may be collected on some beaches or may be bought frozen from fishmongers. Like other shell-fish scallops must be fresh with the shells tightly closed. They can be opened by being placed on top of the stove, when the shells will open by themselves. The scallops should then be removed from the shells and bearded. The deep shells are very useful and attractive for serving various savoury dishes.

Scallops au Gratin

1 quart of scallops
1 teaspoon of salt
½ cup of finely chopped celery
2 tablespoons of grated cheese
1 cup of fine buttered breadcrumbs
½ cup of minced green pepper
1 cup of light cream

Wash and drain scallops; cover with cold water, heat slowly to boiling, and drain. Line a greased baking dish with a thin layer of breadcrumbs. Add scallops in layers, sprinkling each layer with salt, green pepper, and celery until all the scallops are used. Add the cream. Top with the remaining breadcrumbs mixed with the cheese and bake in a moderate oven (350 degrees F.) for 30 minutes.

Pipis and Cockles

Pipis and cockles are usually collected on the beach. They are opened by heating in water and removed when their shells open.

Crayfish

Live crayfish are of a dull colour which varies according to their surroundings, but boiled crayfish are a brilliant red. The humane way of boiling crayfish is to put them in cold water and bring the water to boiling point. The tail is drawn up under the body and the crayfish turns bright red. Crayfish are boiled for 20 to 40 minutes according to size, and then dropped into cold water.

When preparing the crayfish turn it over on its back and cut lengthwise through the body and tail. Remove the cord, which is dark in colour and runs down the centre of the tail. The lungs and stomach are also discarded. The green liver can be eaten if desired and the "coral", which is sometimes found under the tail of the female crayfish, can be used for garnish or to make sauce. Remove the flesh from the shell, which may be washed and dried and used to hold the meat for serving. Legs and claws may be used for decoration of various dishes.

Crayfish Croquettes

1 cup of thick white sauce
2 cups of flaked crayfish meat
½ cup of crumbled bread
2 eggs, lightly beaten
Paprika
½ teaspoon of salt
1 teaspoon of lemon juice
1 tablespoon of minced parsley
Dry breadcrumbs

Mix white sauce, crayfish, and bread; add salt, lemon juice, parsley, and paprika. Mix well and chill. When the mixture is stiff enough to handle mould it into croquettes and dip in egg and then in breadcrumbs. Allow the croquettes to stand for a while to harden the surface and then fry in hot deep fat (385 degrees F.) for about 2 minutes or until golden brown.

Crayfish Thermidor

1 large crayfish
2 tablespoons of finely minced onion
2 cups of milk
1 tablespoon of chopped parsley
2 tablespoons of grated cheese
2 tablespoons of butter
2 tablespoons of flour
Salt
Pepper
3 to 4 tablespoons of fresh breadcrumbs

Cut the crayfish in halves lengthwise; remove the meat from the shells and divide it into neat pieces. Keep the shells and clean them for serving. Melt the butter and fry the onion until soft. Add the flour, mix thoroughly, and gradually add the milk, stirring all the time until the sauce thickens and boils. Heat the meat in the sauce. Add salt and pepper to taste and stir in the chopped parsley. Fill the shells with the mixture. Sprinkle the top with a mixture of breadcrumbs and cheese and dot with a little butter. Bake in a moderate oven for 20 minutes.

Crayfish Newburg (Delicious American Dish)

2 cups of cubed crayfish meat
2 tablespoons of butter
¼ cup of sherry
2 tablespoons of brandy
3 egg yolks, lightly beaten
½ cup of thin cream
½ teaspoon of salt
Cayenne pepper
Nutmeg

(6 servings)

Cook the crayfish in butter for 3 minutes. Add the liquors and cook for 1 minute longer. Mix the egg yolks and cream, add to crayfish, and cook until the mixture just thickens, stirring constantly. If overcooked, the sauce will curdle. Remove from the heat immediately, season with salt, cayenne pepper, and nutmeg, and serve on toast or in patty shells.

Risotto with Crayfish

2 cups of rice
½ cup of olive oil
1 green pepper sliced
1 chopped onion
4 or 5 cups of stock
1lb. of cooked crayfish
4 tablespoons of butter
½ teaspoon of nutmeg
½ teaspoon of turmeric
1 tablespoon of golden syrup
Juice of ½ lemon
½ cup of cream or top of the milk
1 cup of grated cheese
Salt
Pepper

Put the rice in a heavy pan with the oil, green pepper, onion, salt, and pepper and cook gently without browning on a low heat for 5 or 6 minutes, stirring constantly. Then add the stock (hot) and simmer for about 20 to 30 minutes until rice is tender. Risotto must be moist. If it seems a little dry, put a few lumps of butter on top. Flake the crayfish and heat it separately for 3 minutes in the butter, golden syrup, spices, and lemon juice. Then stir in the cream and half the cheese. Put the hot rice in a big serving dish, add the crayfish in the centre, and sprinkle the top with the rest of the cheese.

Prawns and Shrimps

Prawns may sometimes be bought at the fishmonger's and canned shrimps are available in the shops. The shell, legs, and intestinal vein should be removed from prawns. Dishes made from either prawns or shrimps will be expensive, but delicious.

Shrimp and Pineapple Salad

1½ cups of shrimps
1½ cups of diced pineapple
½ teaspoon of paprika
Lettuce leaves
2 sprigs of chopped chives
½ teaspoon of salt
6 tablespoons of french dressing

Combine shrimps, pineapple, chives, salt, and paprika and mix well. Chill thoroughly. When ready to serve mix with french dressing. Arrange on lettuce leaves.

French Dressing

½ tablespoon of salad oil
Pepper
¼ teaspoon of salt
Pinch of dry mustard
½ tablespoon of vinegar

Mix the oil and seasoning and add the vinegar. Stir before using, as the ingredients separate out on standing.

Corn and Shrimp Souffle

1 tin of corn
3 eggs, separated
½ teaspoon of salt
2 teaspoons of sugar
1 tablespoon of melted butter
3 cups of shrimps

(6 servings)

Stir the corn into well-beaten egg yolks; add seasonings, melted butter, and shrimps. Fold in stiffly beaten egg whites. Turn the mixture into a greased casserole, cover, and place in a pan of hot water. Bake in a fairly slow oven (300 degrees F.) for 1 hour or until firm. Remove the cover for the last 10 minutes to brown the top.

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